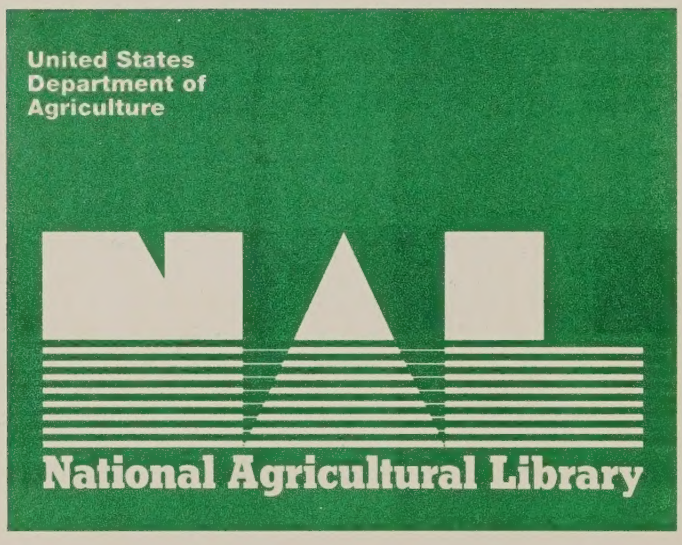
Economic Assessment of the 1983-84 Avian Influenza Eradication Program

Floyd A. Lasley
Sara D. Short
William L. Henson



ECONOMIC ASSESSMENT OF THE 1983-84 AVIAN INFLUENZA ERADICATION PROGRAM. Floyd A. Lasley, Sara D. Short, and William L. Henson, National Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D.C. January 1985. ERS Staff Report No. AGES841212.

ABSTRACT

The 1983-84 outbreak of avian influenza brought heavy losses to the Pennsylvania and Virginia poultry industry and caused consumers to pay nearly $350 million more for poultry and meat products. Benefits of the Federal eradication program substantially exceeded its costs by limiting short-term losses and increases in costs from avian influenza to producers and consumers to less than 10 percent of what would have resulted from a widespread outbreak. Government costs for indemnities and program administration represented only about 1 percent of the probable costs to producers and consumers of a widespread outbreak.

Keywords: Poultry, avian influenza, disease, disease control, quarantine, government programs.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the comments, suggestions, and assistance of Lonnie King, Janet W. Berls, Edward Easterling, Mary Ann Mueseler, and Phyllis Piper.

CONTENTS

	Page
SUMMARY	v
INTRODUCTION	1
Purpose of Study	1
Avian Influenza	2
Procedure in Event of Outbreak	3
OVERVIEW OF THE POULTRY INDUSTRY	4
Consumption Trends	4
Industry Structure	4
Economic Situation at Time of Outbreak	9
ECONOMIC IMPACTS OF 1983-84 AI OUTBREAK	13
Eradication Program	13
Slaughter Plants in Pennsylvania, New Jersey, and Virginia	13
Shortrun Aggregate Impacts of Actual Outbreak	18
Overall Effect of Actual 1983-84 Outbreak	21
Potential Aggregate Impact of AI Spreading to Include Quarantine Area Plus Delmarva Peninsula	23
Potential 6-Month Effect of Widespread AI Outbreak	23
ADDITIONAL IMPACTS AND COSTS OF AVIAN INFLUENZA	27
Producer Losses by Source	28
Community Effects	29
Indemnity Values	34
ECONOMIC IMPLICATIONS OF ERADICATION PROGRAM	36
Longer Run Impacts	37
Policy and Program Implications	38
APPENDIX	40
Procedure Manual for Management of Initial Outbreak of an Emergency Poultry Disease on Delmarva	40
Chart--Regional Emergency Animal Disease Eradication Organization (READO)	43
Chronology of Events	44
Illustration of Indirect Avian Influenza Impacts in Community, Broilers	46
Indemnity Value Tables	48

SUMMARY

Benefits of the Federal-State program to eradicate the 1983-84 outbreak of avian influenza in Pennsylvania and Virginia substantially exceeded the cost of the program. Total losses to affected producers and increases in consumer costs were much lower than likely would have been suffered if no Federal eradication program had been implemented and the disease had become widespread.

The Animal and Plant Health Inspection Service, U.S. Department of Agriculture (APHIS, USDA), spent over $60 million as of September 1, 1984, to eradicate the 1983-84 outbreak of avian influenza that started in Pennsylvania. The greater part of the expenditures (over $40 million) was for indemnity payments to producers whose flocks were depopulated. About one-third of the expenditures were for salaries, travel, rent, and similar costs to administer the eradication program. All the indemnities and a substantial portion of the other costs were expended in the communities stricken by the disease and helped offset part of the economic losses.

Producers suffered direct losses from the 1983-84 outbreak estimated at $55 million in the form of lost birds and eggs. These direct costs were offset by the $40 million paid as indemnities to these producers. Additional costs due to cleanup, disinfecting, transportation, income foregone, and financial hardships were not included in the estimate.

Consumers paid about $349 million more for their protein foods during November 1983 to April 1984 because of the avian influenza outbreak. The relatively small drop in the quantity supplied increased consumer costs an estimated $120 million for eggs, $80 million for broilers, $13 million for turkeys, and $12 million for other chickens. Although avian influenza caused no change in the quantity of pork and beef available, there was a slight increase in those prices, driving up expenditures by $60 million for pork and $64 million for beef.

Producers did not share the burden evenly. Those whose flocks contacted avian influenza bore almost all the cost and burden. Some of the producers whose flocks remained healthy realized prices and profits much above those prior to the avian influenza outbreak. These prices were bid up because of the direct impact of avian influenza in reducing output, the fear of shortages from further outbreak, and the previously planned reduction in production which was just becoming effective when the outbreak occurred.

Contract growers may have been one of the most severely affected poultry groups due to avian influenza and the quarantine. Their total income from poultry is stopped by an outbreak and the subsequent downtime. Contract growers provide the housing and equipment, their labor, and some litter and fuel, but do not own the birds. Therefore, contract growers were not paid indemnities directly by the Government even though those costs were included as part of the production costs. The grower depended upon the contractor to pass along an appropriate portion of the indemnity which was paid to the owner of the birds.

Others especially affected by avian influenza and the eradication program included hatcheries, feed suppliers, other supply firms, processors, distributors, and credit agencies. These firms suffered losses not covered through the indemnity program.

Without the eradication program, the 1983-84 avian influenza outbreak likely would have caused much greater economic havoc. There is a high probability that it would have become widespread, threatening much of our poultry industry, severely disrupting markets, and completely stopping our exports to other countries. Had the outbreak spread throughout the Eastern United States (generally east of the Mississippi River), losses would have been far greater. Although affected producer losses would have been substantial (estimated at $508 million), consumers would have borne most of the cost as shortages would have increased protein food costs by about $5.6 billion during November 1983 to April 1984. Those producers not affected by avian influenza would have had the potential for unusually high profits because of higher product prices.

Economic Assessment of the 1983-84 Avian Influenza Eradication Program

Floyd A. Lasley
Sara D. Short
William L. Henson

INTRODUCTION

The 1983-84 outbreak of avian influenza brought heavy losses to the Pennsylvania and Virginia poultry industry and caused consumers to pay nearly $350 million more for poultry and meat products. Benefits of the Federal eradication program substantially exceeded its costs by limiting short-term losses and increases in costs from avian influenza to producers and consumers to less than 10 percent of what would have resulted from a widespread outbreak.

Purpose of Study

This analysis identifies some of the major costs of the avian influenza, as well as costs and benefits of the eradication program. Three different scenarios are presented which consider costs to producers, consumers, and government.

The analysis provides guidelines for evaluating the economic worth of the current eradication program and for implementing an eradication program in the event of future disease outbreaks. Estimates and assumptions regarding the spread and severity of the disease, extent and rate of recovery of surviving birds, effectiveness of the control program, availability of flock replacements, and the reactions of producers, processors, and consumers all influence the outcome of economic comparisons. Major assumptions and estimates are set forth when applicable.

Poultry producers generally consider the risk of disease in their flock as a part of the normal cost of producing poultry or eggs. However, some diseases may occur so infrequently that they are not considered as a current threat or may be so severe that the individual cannot cope with them and are considered by the industry as a general threat. The outbreak of highly lethal avian influenza (AI) which occurred in Pennsylvania in November 1983 fits both the infrequent and severe categories. Control or eradication of the disease by individual producers or by the industry was not considered a viable option, so Federal intervention was requested by the industry and State officials. The decision was made to eradicate the disease by means of an all-out attack.

Avian Influenza

AI is an acute, highly contagious viral disease to which all avian species are susceptible. The severity of the disease varies from inapparent effects to sudden death of over 90 percent of the birds in affected flocks, depending upon the strain of virus and the susceptibility of the infected birds. When the disease causes death in flocks, it is sometimes called "lethal avian influenza." This term was used with respect to the 1983-84 outbreak to designate the virus strain associated with the quarantined area in Pennsylvania and any other area to which the strain had spread.

A decrease in the consumption of feed and water is an early sign of AI. In laying hens, this condition is accompanied by the production of soft-shell eggs and a sudden, often severe, decrease in egg production. Swelling of the head and lower leg joints, a bluish discoloration of the comb and wattles, and hemorrhages in unfeathered skin are common. Depression is often severe. Sudden death may occur with severe dehydration without other apparent abnormalities. Chickens and turkeys raised in confinement appear to be more likely to develop clinical signs of disease. Crowding may play a role in allowing the disease to spread. The period of time required to obtain marketing weights is delayed in infected birds that recover and some of the infected hens never return to production because of damage to the reproductive system.

Detailed, precise laboratory tests are used to identify AI virus in order to rule out other diseases, such as Newcastle disease, which have similar clinical signs. The source of AI viruses is generally not known. The viruses are either introduced from other flocks or are introduced from outside sources, such as migratory birds from which AI viruses have commonly been isolated.

AI is easily spread by virus-contaminated people, the movement of infected birds and contaminated eggs, feed delivery trucks, other vehicles, equipment, egg flats, and other means. Almost everything associated with infected birds is capable of transmitting the virus. Once a bird becomes infected, it sheds the virus and contains extremely high concentrations of the virus in almost all tissues and manure. Thus, any contact with these birds can result in the spread of the disease. Infected carcasses also pose a potential risk of spreading AI since the virus can survive in a dead host for varying lengths of time. Furthermore, the weather affects the transmission of influenza viruses. Cold, wet weather plays a significant role. Such weather conditions not only enhance virus survival, but also tend to stress poultry, rendering them more susceptible to disease. The viruses are susceptible to ultra-violet light and drying, so their survival is markedly reduced in hot, dry weather.

There is no known cure for AI. If the viruses appearing during disease outbreaks are introduced by migratory birds, containment may be the most effective means for preventing introduction of the viruses. If this method is not feasible or if the viruses are contained within flocks, producers may have to rely on vaccines. However, there is no effective vaccine for all types of poultry. Since 1979, vaccines for turkeys have been available. Because of the numerous types of AI viruses, it is very difficult to determine the type of vaccine to use each year. Influenza is a frequent problem in turkeys, particularly in North America.

There is a vaccine made from H5N2 AI virus (the strain diagnosed in Pennsylvania; H5 and N2 designate specific components of the virus) isolated

in Minnesota and further modified at St. Jude Children's Hospital for increased production of antibodies. However, this vaccine has been cleared for only experimental use on turkeys. Birds that have received the vaccine nevertheless can still become infected, but they do not become as sick and may not shed as much virus. However, as healthy carriers, they can shed the virus over a much longer period. If this vaccine is used, commercial slaughter of such poultry is restricted for 6 weeks. This length of time precludes the broiler industry from using the vaccine.

Procedure in Event of Outbreak

An AI outbreak with a high mortality rate and devastating economic losses had not been identified in chickens in the United States since 1929. However, outbreaks of milder forms of the disease have been reported for the last two decades. With the exception of a few cases, the outbreaks have occurred in turkey flocks, and since the 1970's have been an annual occurrence in some turkey-producing States. These outbreaks are generally mild and financial losses are related mostly to the drop in egg production in turkey breeders and the weight loss in market turkeys. However, when the mortality rate is relatively high, infected flocks are depopulated in order to stop additional losses. In addition, contaminated facilities and equipment are disinfected and self-imposed quarantines are set up to prevent the virus from spreading outside the premises. The cost of such actions may be absorbed entirely by the individual affected, but it is likely that assistance will be provided by the industry. The annual occurrence of AI in turkeys is perceived as an industry problem and has been handled as such without Federal involvement. However, State assistance is obtained in the form of laboratory diagnosis of the disease.

Some States, coordinating with private industry, have emergency contingency plans for the control and eradication of poultry diseases. These plans include provisions for the imposition of State quarantine of infected areas, the depopulation of infected flocks, and the disbursal of indemnity payments to owners of depopulated flocks. However, monies needed to fully carry out these plans must be appropriated on an as-needed basis from State legislatures.

In some areas, private industry, coordinating with State and Federal officials, has set up emergency poultry disease task forces to develop and implement plans to stop a threat or to control and/or eradicate emergency poultry diseases that could result in serious economic losses to the commercial poultry industry. Such a task force was set up by the Delmarva poultry industry in 1975 in response to an outbreak of Newcastle disease. The task force subsequently prepared a procedure manual for the management of initial outbreaks of an emergency poultry disease on Delmarva (app. 1). The manual outlines procedures for handling suspect farm premises, requirements of company quarantine, and activities performed by the task force during an emergency.

If it becomes apparent that State and industry resources are not sufficient to undertake adequate measures to control a disease outbreak, steps can be taken by APHIS' Veterinary Services (VS) to activate the appropriate Regional Emergency Animal Disease Eradication Organization (READEO) (app. 2). Five READEO units were organized in the mid-1970's on the basis that a preselected, pretrained unit of animal health specialists can eradicate a disease more rapidly and efficiently than a group pulled together at the time a disease outbreak occurs. These units were created within the framework of the five

existing VS regions (fig. 1) and are backed by the expertise of APHIS's Emergency Programs Staff. Federal, State, university, military, industry, and other sources were tapped for personnel to fill key positions. Each Assistant Regional Director for VS is responsible to the National Emergency Field Operations, Emergency Programs, for the readiness of the READEO unit. When activated, either the Regional Director or the Assistant Regional Director is relieved of all other duties and automatically becomes the READEO Task Force Director. In the absence of a declared national emergency during the fiscal year, the individual READEO is activated for a test exercise not to exceed 1 week. A READEO organizational chart is presented in appendix 2, and the functional responsibilities of a unit during an emergency are available from APHIS.

OVERVIEW OF THE POULTRY INDUSTRY

Consumption Trends

The average consumer eats more broiler and turkey meat but fewer eggs than before (table 1). Per capita consumption of broilers increased from 36.8 pounds in 1970 to 50.9 pounds in 1983. Per capita consumption of turkey increased from 8 pounds to 11.2 pounds. On the other hand, per capita egg consumption declined from 309 to 261. Chicken and turkey made up about 24 percent of total red meat and poultry consumption in 1970 and 31 percent in 1983.

Consumer expenditures averaged $37.04 per person for broilers and $10.27 for turkey in 1983, about a half of a percent of disposable income. This represented only about 13.9 percent of expenditures for red meat and poultry. Retail prices for poultry and eggs have increased less rapidly than the rate of inflation. Lower real (deflated) prices have encouraged consumers to use more poultry meat.

Industry Structure

The commercial poultry industry is made up of a small number of large-volume farms and processing plants. It is a highly coordinated and complex agribusiness. Most of the volume is produced on specialized poultry farms as part of vertically integrated operations combining most phases of production, processing, and marketing to the wholesale level. This structure must be considered when weighing the impact of some occurrence, such as AI, upon the industry.

Almost 250,000 farms produced broilers, turkeys, or eggs in 1982. Most of these produced rather small volumes of poultry, but a limited number have grown to relatively large specialized businesses. Fewer than 50,000 farms sold most of the nearly $10 billion gross receipts generated by poultry and poultry products in 1982 (table 2).

In 1982, about 31,000 eastern poultry farms (east of Mississippi River, excluding Wisconsin, plus Arkansas) sold $6.8 billion of poultry and poultry products, accounting for 70 percent of the U.S. total sales. More than 4,700 farms located in the area which was quarantined because of the 1983-84 AI outbreak reported poultry production in the 1982 Agriculture Census. Of these, 3,236 farms reported an inventory of 18 million hens and pullets of laying age, but only 558 had over 3,200 hens, accounting for 17.6 million

FIGURE 1

United States Department of Agriculture
Animal and Plant Health Inspection Service

Veterinary Services Regions

Table 1.--Per capita consumption of poultry and red meat

Year	Eggs	Chickens: Young	Chickens: Mature	Chickens: Total	Turkey	Chicken and turkey	Beef	Veal	Pork	Lamb and mutton	Red meats	Red meat and poultry
	Number	Pounds, RTC* basis					Pounds, retail basis					
1955	371.0	13.8	7.5	21.3	5.0	26.3	64.0	7.8	61.9	4.1	137.8	164.1
1956	358.2	17.3	7.1	24.4	5.2	29.6	66.2	7.9	62.2	3.9	140.2	169.8
1957	351.3	19.1	6.4	25.5	5.9	31.4	65.1	7.3	56.6	3.6	132.6	164.0
1958	343.3	22.0	6.1	28.1	5.9	34.0	61.5	5.6	55.9	3.6	126.6	160.6
1959	341.3	22.8	5.9	28.9	6.3	35.2	61.8	4.7	62.7	4.2	133.4	168.6
1960	320.5	23.4	4.4	27.8	6.1	33.9	64.2	5.1	60.4	4.2	133.9	167.8
1961	318.1	25.9	4.0	29.9	7.4	37.3	65.9	4.6	57.7	4.4	132.6	169.9
1962	319.5	25.8	4.0	29.8	7.0	36.8	66.2	4.6	59.1	4.5	134.4	171.2
1963	313.8	27.1	3.6	30.7	6.8	37.5	69.8	4.1	61.0	4.3	139.2	176.7
1964	317.8	27.7	3.5	31.2	7.3	38.5	73.9	4.3	60.9	3.7	142.8	181.3
1965	313.1	29.6	3.7	33.3	7.4	40.7	73.6	4.3	54.7	3.3	135.9	176.6
1966	312.3	32.0	3.6	35.6	7.8	43.4	77.0	3.8	54.3	3.5	138.6	182.0
1967	320.7	32.4	4.1	36.5	8.5	45.0	78.8	3.2	59.9	3.5	145.4	190.4
1968	315.5	32.8	3.9	36.7	7.9	44.6	81.2	3.0	61.4	3.3	148.9	193.5
1969	310.3	34.8	3.6	38.4	8.2	46.6	82.0	2.7	60.5	3.0	148.2	194.8
1970	309.0	36.8	3.6	40.4	8.0	48.4	83.9	2.6	63.2	2.9	152.6	201.0
1971	310.6	36.5	3.8	40.3	8.3	48.6	83.3	2.4	69.2	2.8	157.7	206.3
1972	302.9	38.2	3.6	41.8	8.9	50.6	85.4	2.1	63.7	3.0	154.2	204.8
1973	289.2	37.2	3.3	40.5	8.5	48.9	80.6	1.7	58.1	2.4	142.8	191.7
1974	283.7	37.2	3.5	40.7	8.8	49.5	85.6	2.1	62.9	2.0	152.6	202.2
1975	277.1	36.7	3.4	40.1	8.5	48.5	87.9	3.7	51.6	1.8	145.0	193.5
1976	270.0	39.9	2.9	42.8	9.1	51.8	94.3	3.5	54.6	1.6	154.0	205.8
1977	267.0	41.1	3.1	44.2	9.1	53.2	91.6	3.4	56.7	1.6	153.3	206.6
1978	272.2	43.8	2.9	46.7	9.1	55.8	87.1	2.6	55.9	1.3	146.9	202.7
1979	277.5	47.7	2.9	50.6	9.9	60.4	78.0	1.8	63.8	1.3	144.9	205.4
1980	273.2	47.0	3.1	50.2	10.5	60.6	76.5	1.7	68.3	1.3	147.8	208.4
1981	265.0	48.6	3.1	51.7	10.7	62.4	77.3	1.7	65.0	1.5	145.5	207.9
1982	265.4	50.0	3.1	53.1	10.7	63.8	77.2	1.7	59.0	1.5	139.4	203.2
1983	261.2	50.9	3.0	53.9	11.2	65.1	78.8	1.6	62.2	1.5	144.2	209.3

* RTC = Ready to cook.

Source: Agricultural Statistics, various issues; Livestock and Poultry Situation reports, ERS, USDA, various issues.

Table 2.--Inventory or sales of poultry in quarantine and other selected areas 1/

State	Hens and pullets of laying age				Broilers sold 2/		Turkeys sold		Value of poultry sold 3/
	Farms	1,000 hens	Farms over 3,200 hens: Farms	1,000 hens	Farms	1,000 head	Farms	1,000 head	
	Number								$ Million
Quarantine area 4/	3,236	17,900	558	17,502	805	153,992	580	8,308	535
Pennsylvania	2,567	16,085	460	15,746	563	81,769	133	2,812	335
New Jersey	166	357	8	345	18	76	11	1	4
Virginia	503	1,458	90	1,411	314	72,147	436	5,495	196
Delmarva Peninsula 5/	595	1,920	110	1,717	2,279	416,065	28	-D-	577
Delaware	240	742	40	724	922	170,418	10	-D-	221
Maryland	323	1,158	67	973	1,300	234,547	16	-D-	343
Virginia	32	20	3	20	57	11,100	2	-D-	13
Quarantine area plus Peninsula	3,831	19,820	668	19,219	3,174	570,057	608	8,308	1,112
Total of States quarantined or Peninsula 6/	16,029	30,123	906	28,852	4,231	629,570	900	15,803	1,347
Eastern United States 7/	101,802	196,773	6,566	192,250	21,542	2,987,113	3,812	80,239	6,798
U.S. total	212,639	310,779	8,941	301,128	30,104	3,509,893	7,513	171,426	9,702
	Percent of U.S. total								
Quarantine area	1.52	5.76	6.24	5.81	2.97	4.39	7.72	4.85	5.51
Pennsylvania	1.21	5.18	5.14	5.23	1.87	2.33	1.77	1.64	3.45
New Jersey	.08	.11	.09	.12	.06	0	.15	0	.04
Virginia	.24	.47	1.01	.47	1.04	2.06	5.80	3.21	2.02
Delmarva Peninsula	.28	.62	1.23	.57	7.57	1.85	.37	-D-	5.95
Delaware	.11	.24	.45	.24	3.06	4.86	.13	-D-	.28
Maryland	.15	.37	.75	.32	4.32	6.68	.21	-D-	3.54
Virginia	.02	.01	.03	.01	.19	.32	.03	-D-	.13
Quarantine plus Peninsula	1.80	.38	7.47	6.38	10.54	16.24	8.09	4.85	11.46
Total States quarantined plus Peninsula	7.54	9.69	10.13	9.58	14.06	17.94	11.98	9.22	13.88
Eastern United States 7/	47.88	63.32	73.44	63.84	71.56	85.11	50.74	46.81	70.07

-D- = Not shown to avoid disclosure. 1/ From 1982 Census of Agriculture, some from preliminary reports. Except for in Delmarva Peninsula, county data were estimated when not shown by Census due to small numbers of producers. 2/ Total broilers sold in U.S. total compared with the 4,151 million reported by SRS, USDA, as produced in fiscal year 1982. 3/ Sales of poultry and poultry products from farms with at least $10,000 in total sales. 4/ Quarantine area includes all of those counties in Pennsylvania, New Jersey, and Virginia in which any part was quarantined because of avian influenza November 1983 - May 1984. 5/ Delmarva Peninsula includes all of Delaware plus nine counties in Maryland and two in Virginia. 6/ Total for States with any part quarantined or on the Peninsula. 7/ Total for Eastern United States; those States east of the Mississippi River excluding Wisconsin but including Arkansas.

hens. Nearly 154 million broilers were sold from 895 farms, and 580 farms in the area sold 8.3 million turkeys.

The poultry industry is more vertically integrated than are the other animal enterprises. All but 1 percent of the Nation's broilers are produced by contract growers or on farms owned by the integrators. About 80 percent of all turkeys are produced under these arrangements and another 10 percent are marketed under contract. Likewise, about 81 percent of market eggs are produced either under contract or on the integrators' farms and 9 percent are under marketing contracts. This means that during the production period, integrators own or market under contract about 90 percent of the turkeys and laying hens and about 99 percent of all broilers.

The processor is generally the integrator, so that the first actual sale or ownership transfer is at the wholesale market level. The integrator usually owns the processing plant, the feed mill, hatchery, breeder flocks, and birds in the growout cycle.

The poultry industry is one of the more concentrated of the major agricultural industries (table 3). Over half of all turkeys are slaughtered by the top eight firms. Likewise, the eight largest broiler processors slaughtered over 40 percent of total broilers in 1981.

The 35 largest plants, those processing over 30 million birds a year, slaughtered nearly 1.5 billion broilers in 1981, about 37 percent of the total. The 20 largest turkey plants, each processing at least 3 million turkeys a year, slaughtered 57 percent of the total in 1981.

Comparable data for egg processors are not available, but the Poultry Tribune (June 1981) listed 47 firms, each with more than 1 million hens, accounting for 31 percent of commercial egg production.

Table 3.--Structural comparisons of poultry slaughter plants under Federal inspection, 1981

Item	Young chickens	Fowl	Turkey
Slaughter:			
Head (Mil.)	4,076	197	166
Pounds R.T.C. (Mil.)	11,906	538	2,509
Plants slaughtering (No.)	243	72	129
Plants with 20 percent of volume (No.)	9	3	5
Eight largest firms as percentage of total U.S. volume	41.4	60.8	52.6

Source: Unpublished data, Food Safety and Inspection Service (FSIS), USDA.

Economic Situation at Time of Outbreak

The economic setting of the industry at the time of the AI outbreak and some of the adjustments made during November 1983 to May 1984 provide the background for analyzing the impact. AI had a greater impact because it occurred at a critical time and place.

Poor returns in 1982 and 1983, combined with prospects for high feed costs, caused egg producers to reduce hen numbers in second-quarter 1983. As egg output began declining, the impact of AI reduced production further. The disease and the eradication program interacted with the previously planned cutback.

At the time of the AI outbreak, USDA was projecting an egg output for 1983 nearly 3 percent below that for 1982, due to a smaller laying flock (table 4). Layer numbers on December 1, 1983, totaled 278.2 million, down 10.8 million from December 1, 1982. Pullets hatched were down 9 percent from the previous year. First half 1984 egg production was projected to be 1 to 3 percent below a year earlier.

Seasonal demand was strong for eggs for the holiday trade. During October, egg breakers had been bidding for eggs to meet current orders and New York prices for cartoned Grade A large eggs rose to 80.2 cents, up from 69.5 cents a year earlier. In light of these conditions, buyers responded immediately to the news of the AI-induced drop in production in Pennsylvania (the fourth largest egg-producing State, situated next to major East Coast consuming centers). Egg prices rose one-third above a year earlier in November and through December increased by one-half, breaking the $1 barrier at wholesale (table 5).

Egg producers responded to the changing situation almost as rapidly as did the buyers. Producers kept older flocks in production that normally would have gone to market. Only 11.3 million mature fowl were slaughtered for market in November 1983 and 12.2 million in December. This was a 2-month drop of 11.1 million from the previous year when slaughter was 15.4 million in November and 19.1 million in December. By holding back older hens, egg producers more than offset the number depopulated because of AI. By late May, egg prices had dropped to almost previous levels.

The dramatic decline in spent hen slaughter also disrupted the fowl market and some processors were unable to meet commitments for fowl meat. This was especially the case in the Mid-Atlantic area, which draws heavily upon Pennsylvania as a source of fowl. The farm price for live hens more than doubled, increasing to 25 cents per pound. In May, the reverse situation occurred as the backlog of older hens started to market, driving the price down to about the same level as before AI.

Broiler prices also responded to lower supplies, even though the number depopulated because of AI had been small compared with normal slaughter (table 6). During November and December, only 3.2 million broilers were depopulated, but federally inspected slaughter of 623 million birds for market was 13.4 million below those 2 months in 1982, a drop of 2.1 percent. Depopulation because of AI accounted for only 25 percent of the drop. The main reduction again was due to cutbacks by producers reacting to poor returns in 1982 and early 1983 as well as expectations of higher feed costs and large supplies of red meat in second-half 1983 and early 1984. Broilers were not in short

Table 4.--Egg production, layer inventory, and poultry federally inspected for slaughter

Month	Egg production	Layer inventory first of month	Federally inspected slaughter		
			Mature chickens	Young chickens	Turkey
	Millions		Thousands		
January 1982	5,975	---	17,207	315,510	7,885
February	5,333	---	15,573	310,082	7,804
March	---	288,505	18,477	357,859	10,693
April	---	---	20,027	341,112	9,767
May	---	---	16,565	338,337	10,888
June	---	282,776	17,928	367,476	14,306
July	---	---	14,249	352,584	15,310
August	---	---	17,024	360,424	17,879
September	---	281,776	15,494	351,952	17,799
October	---	---	14,736	336,440	17,758
November	---	---	15,433	312,009	18,546
December	6,012	288,968	19,124	324,325	11,725
January 1983	5,914	285,607	18,963	340,252	8,532
February	5,353	283,308	14,875	313,680	8,477
March	5,928	280,501	19,070	368,250	11,979
April	5,622	276,921	17,498	345,740	10,563
May	5,710	272,632	13,519	364,275	12,065
June	5,530	271,721	14,798	373,732	15,201
July	5,654	269,986	13,420	332,128	14,927
August	5,635	270,179	14,637	380,313	18,396
September	5,501	271,290	14,319	349,947	17,444
October	5,683	272,058	13,266	341,530	18,102
November	5,566	276,009	11,263	309,773	17,931
December	5,767	278,223	12,227	313,208	11,329
January 1984	5,689	277,057	13,022	340,242	8,138
February	5,328	276,031	12,709	323,502	8,898
March	5,798	276,966	14,136	348,611	9,937
April	5,644	279,305	14,462	342,917	10,462
May	5,738	276,638	16,044	376,380	123,718

--- Not surveyed on monthly basis during these months.

Source: Eggs, Chickens and Turkeys, Crop Reporting Board, SRS, USDA, various issues; Livestock and Poultry Situation and Outlook report, ERS, USDA, various issues.

supply even during the peak of the AI-induced depopulation. Yet, wholesale prices rose about one-third over the 42-cent level of a year earlier when the market was badly depressed because of large supplies. However, by May, prices had dropped almost to the level prior to the outbreak.

The AI outbreak developed more slowly in turkeys, but the impact may be more drawn out than for eggs and broilers. The main marketing period for turkeys was nearly over when the outbreak occurred. Only 54,029 turkeys were depopulated during November-December, but the number increased to three-quarters of a million by the end of March, when depopulation was equal to 5 percent of slaughter for market. A sizable number of those destroyed were turkey breeding flocks. This may be a factor behind the decline in turkey placements and eggs set; eggs may be less available. If so, this increases the uncertainty regarding supplies during the fall marketing period.

Table 5.--Wholesale prices for eggs, broilers, and turkeys

Month	Eggs Grade A large 14-city	Broilers 12-city	Young turkeys 3-city
	Cents/dozen	Cents/pound	
January 1983	64.3	1/43.4	56.5
February	65.3	1/45.2	57.1
March	69.7	1/41.9	55.9
April	67.9	1/40.9	54.8
May	70.9	46.5	58.6
June	68.7	49.1	62.3
July	70.1	52.8	61.4
August	76.9	54.2	62.1
September	79.0	54.5	67.2
October	81.3	50.4	68.4
November	90.6	56.8	70.2
December	100.1	57.1	75.9
January 1984	112.4	62.1	73.4
February	104.2	61.2	67.9
March	92.5	62.0	69.7
April	103.8	56.0	70.5
May	77.6	57.6	69.8
June	70.9	55.5	70.3
July	70.6	57.3	72.4
August	70.0	51.5	75.4
September	70.1	53.6	77.8

1/ 9-city average was discontinued and replaced by composite 12-city average in May, increasing the price quote approximatley 2.5 cents.
Source: Livestock and Poultry Situation and Outlook report, ERS, USDA, various issues.

Table 6.--Poultry depopulation comparisons, through May 1984

Month	Layers depopulated 1/			Young chickens depopulated		Turkeys depopulated		Depopulated	
	Head	As percentage of-- Inventory	As percentage of-- FI slaughter	Head	As a percentage of FI slaughter	Head	As a percentage of FI slaughter	Other	Total
	Number	- - Percent - -		Number	Percent	Number	Percent	- - Number - -	
November 1983	1,888,160	0.68	16.76	1,508,571	0.49	0	0	15,942	3,412,673
December 1983	3,030,360	1.09	24.78	1,705,528	.54	54,029	0.48	18,601	4,808,518
January 1984	1,605,219	.58	12.33	343,725	.10	37,041	.46	1,675	1,987,660
February 1984	1,035,510	.38	8.15	97,422	.03	133,562	1.53	105	1,266,599
March 1984	196,549	.07	1.39	163,415	.05	521,679	5.25	0	881,643
April 1984	391,645	.10	2.74	107,424	.03	150,670	1.44	7	649,746
May 1984	1,131,024	.41	7.05	0	0	48,369	.34	0	1,208,832
Total to May 31	9,278,467			3,926,085		940,350		36,330	14,215,671

1/ Includes layers, pullets, breeders. 2/ Based upon FI slaughter of mature chickens.
Source: Livestock and Poultry Situation and Outlook report, ERS, USDA, various issues; APHIS, Recorded Emergency Animal Disease Information (READI) System.

ECONOMIC IMPACTS OF 1983-84 AI OUTBREAK

Eradication Program

AI was first found in the poultry flocks of southeastern Pennsylvania in April 1983. The strain was mildly pathogenic and thought to be self-limiting. However, in mid-October, mortality in flocks began increasing at an alarming rate. The threat of this highly pathogenic form spreading to areas outside of Pennsylvania led Federal officials to convene a technical advisory committee of Federal, State, industry, and academic specialists in the poultry field who recommended that a Federal quarantine be imposed and an eradication program for the highly pathogenic strain begin immediately. The northern READEO unit was subsequently activated to enforce Federal quarantines and the eradication program (see app. 3 for a chronology of events).

An extraordinary emergency was declared November 9, 1983, by the Secretary of Agriculture and funds were made available from the Commodity Credit Corporation (CCC). As eradication efforts continued through December 1983, the virus spread to flocks outside of the original four-county area and the quarantine zone. By late December, all or part of nine counties in Pennsylvania and a portion of one county in New Jersey were under Federal quarantine (figs. 2 and 3).

It was initially thought that influenza could be easily differentiated between high- and low-pathogenic strains. By December 1983, it had become evident that current diagnostic methods were not sensitive enough to distinguish high- from low-pathogenic infected flocks. This was evidenced by flocks which experienced high mortality, but whose virus produced no deaths when innoculated in laboratory chickens. The inability to assure that high-pathogenic AI was not present in a flock diagnosed with the low-pathogenic strain, or to assure that recovered flocks were not still shedding the virus, prompted Federal officials to review the eradication policy. The technical advisory group was reconvened to review the effectiveness of the eradication program and recommended that the goal of the program be changed to aim for total eradication of all forms of the influenza. In response to this recommendation, APHIS expanded eradication activities by beginning active surveillance to seek out all foci of the disease and subsequently depopulating all infected flocks (table 7). This involved depopulation and indemnification for all flocks diagnosed with the low-pathogenic strain, including outbreaks outside the quarantine area that could be traced back to it. These flocks were previously placed only under State quarantine. Cleaning and disinfecting continued to be done by owners and was required before producers were permitted to restock. Pennsylvania provided limited funds to producers early in the outbreak to help defray costs of disinfection.

By late January 1984, portions of Maryland and Virginia were placed under Federal quarantine (figs. 4 and 5). Areas under quarantine in these two States as well as in Pennsylvania and New Jersey were not released from quarantine until it was determined that they were free of lethal AI. As of August 24, 1984, over $40 million had been disbursed in indemnity payments with total program costs being over $60 million (table 8).

Slaughter Plants In Pennsylvania, New Jersey, and Virginia

The quarantine area in Pennsylvania, New Jersey, and Virginia included some marked contrasts in size and capacity of slaughter plants. For example, in

Avian Influenza

Portions of, or Entire Counties Quarantined in Pennsylvania

-- Original quarantine boundary

▬ Quarantine boundary 6/8/84

···· Area released from quarantine

FIGURE 3

Avian Influenza

New Jersey Quarantine Area

Positive premises Quarantine:

Original—11/23/83

Reduced—12/30/83

Table 7.--Total depopulation by class
(November 1983 through August 21, 1984)

Class	Numbers	Indemnity
		Dollars
Chickens:		
Layers	11,571,433	27,491,635
Eggs (dozens)	1,226,541	1,019,485
Breeders	444,869	2,250,279
Broilers	3,962,554	4,639,827
Other	43	167
Ducks	1,280	8,176
Geese	313	5,420
Guinea fowl	30,406	227,944
Pheasants	501	2,160
Quail	6,198	27,513
Turkeys:		
Eggs (dozens)	48,000	20,160
Breeders	51,535	647,805
Market	811,150	3,774,683
Other	83,754	347,911
Other	46	2,125
Feed (pounds)	5,419,110	801,842
Materials	3,031,017	245,237
Total	NA	41,512,369

NA = Not applicable.
Source: APHIS, Recorded Emergency Animal Disease Information (READI) System.

Table 8.--Government costs of AI eradication program
(November 1983 through August 21, 1984)

Cost items	Costs
	Dollars
Indemnity payments:	
Poultry depopulated	39,425,645
Eggs destroyed	1,039,645
Feed destroyed	801,842
Materials destroyed	245,237
Total indemnities	41,512,369
Other costs:	
Salaries and benefits	9,705,068
Travel	2,795,835
Transportation	174,048
Rent, communication, utilities	414,981
Other services, supplies, equip.	6,111,955
Total other	19,201,887
Total costs	60,714,256

Source: APHIS, Recorded Emergency Animal Disease Information (READI) System.

1982, 13 turkey slaughtering plants operated in Pennsylvania, 2 in Virginia, and 4 in New Jersey. However, the plants in Virginia each processed more than all the Pennsylvania and New Jersey plants combined. Five of the plants slaughtered more than 1 million head per year, 3 slaughtered more than 100,000, and 11 slaughtered fewer than 60,000 head. The Virginia plants operate on a year-round basis while several in Pennsylvania and New Jersey operate only seasonally.

Virginia's broiler plants also are larger than those in Pennsylvania and New Jersey, where 8 out of 15 slaughter fewer than 1 million birds annually while none are that small in Virginia.

Neither Pennsylvania nor Virginia plants slaughter many fowl. The four New Jersey spent-hen plants slaughter 95 percent of the three-State total, drawing heavily from the Pennsylvania egg producing area. Lack of fowl slaughter capacity created problems for those in the quarantine area. The number of slaughtering plants and poultry slaughtered in Pennsylvania, New Jersey, and Virginia in 1982 were (disclosure problems prevent showing a breakout by State):

Young Chickens		Turkeys		Fowl	
Plants	1,000 head	Plants	1,000 head	Plants	1,000 head
23	315,241	19	24,321	11	22,372

Shortrun Aggregate Impacts of Actual Outbreak

All segments of the industry and consumers felt economic impacts from the 1983-84 outbreak. Explicit estimates of these impacts consider the losses suffered by producers whose flocks were affected and the higher prices paid by consumers for poultry and meat products.

Aggregate shortrun economic impacts of AI were compared under three different scenarios so as to estimate the costs and benefits of the eradication program. The first scenario considers the actual case of the 1983-84 outbreak. The second scenario shows the probable impact if AI had spread to include the actual quarantined area plus the Delmarva Peninsula before being contained by the eradication program. The third scenario assumes that no eradication program was put in effect and estimates the shortrun impact of a widespread outbreak covering the Eastern United States.

The FAPSIM (Food and Agricultural Policy Simulator) model 1/, which is based upon historical relationships, was used to estimate changes in prices and

1/ FAPSIM is an annual econometric model of the agricultural sector used as an analytical tool by the National Economics Division, ERS, USDA. It contains submodels for beef, pork, dairy, poultry and eggs, corn, grain, soybeans, oats, barley, wheat, cotton, and soybeans which are linked via common variables. The model estimates a price-quantity equilibrium solution that is consistent across all commodities. Estimated quantity changes were exogenously introduced into the model, which then simulated a new price quantity equilibrium. See Larry E. Salathe, J. Michael Price, and Kenneth E. Gadsen, "The Food and Agriculture Policy Simulator: The Poultry and Egg-Sector Submodel," Agricultural Economic Research, Vol. 35, No. 1, January 1983.

FIGURE 4

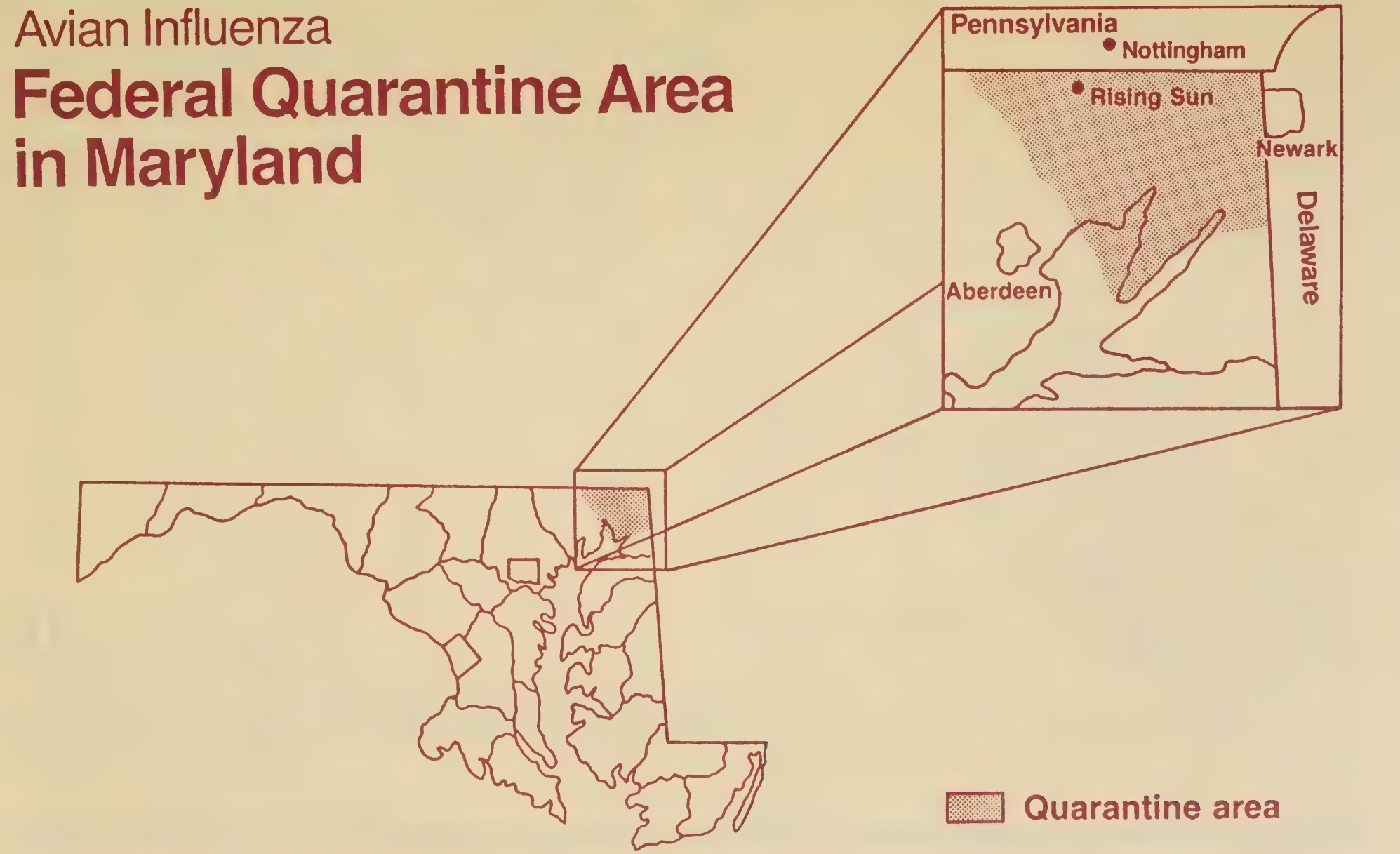
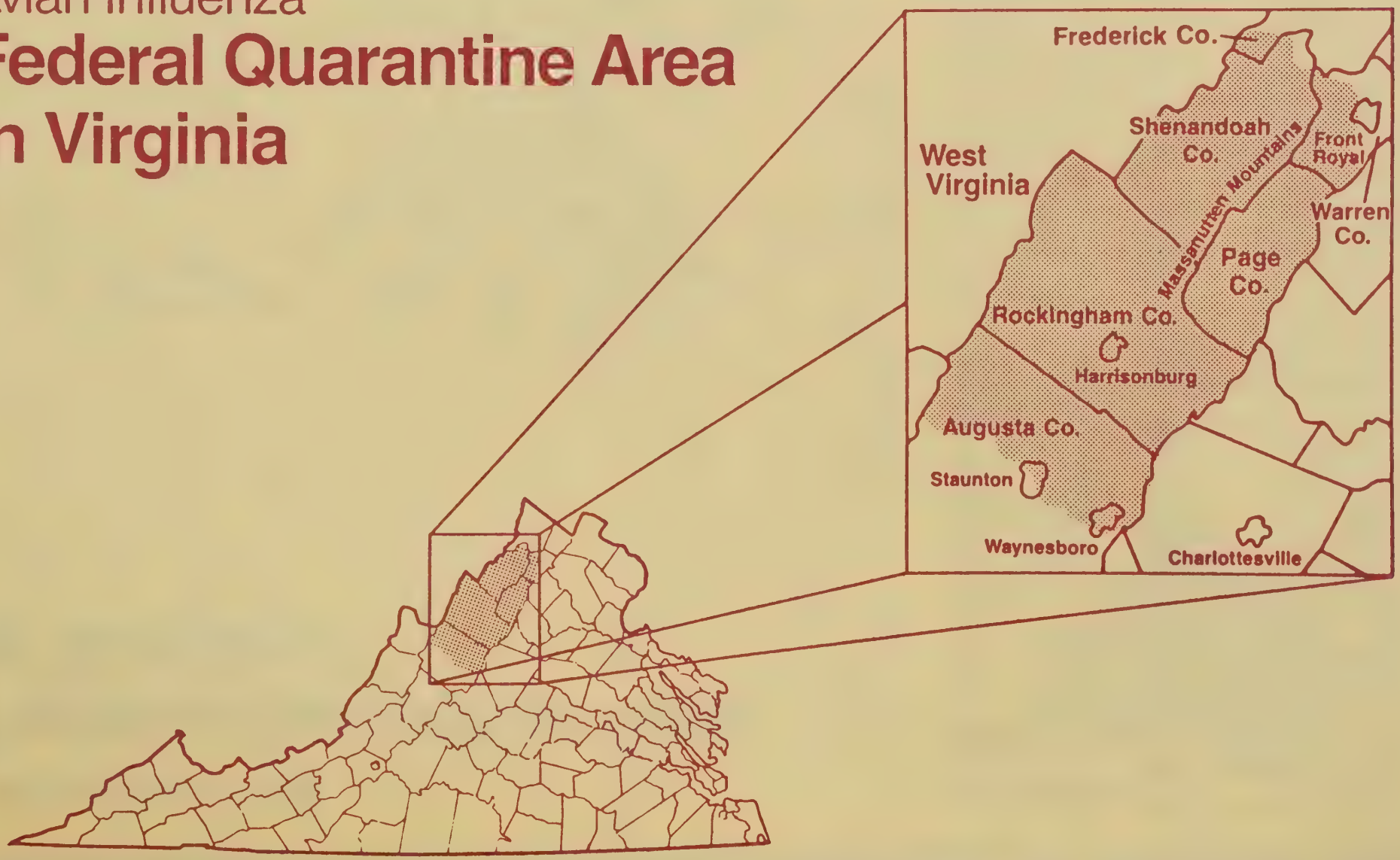

Avian Influenza
Federal Quarantine Area in Maryland
Pennsylvania
Nottingham
Rising Sun
Newark
Delaware
Aberdeen
Quarantine area

FIGURE 5

Avian Influenza

Federal Quarantine Area in Virginia



expenditures for poultry and meat products because of changes in output due to AI. This annual model, although probably underestimating the shortrun price impacts of such dramatic changes in supply, provides meaningful comparison of relative changes expected under the three alternatives.

Consideration was given to the dynamics of the market when the outbreak occurred. That portion of the industry not stricken by AI made adjustments that offset much of the decreased production from those affected by (except for fowl slaughter). The industry can do this when the infected area and population is relatively small, but not when the stricken population is widespread. In addition, infected birds were depopulated under the eradication program and none of them were slaughtered for market. All birds in affected flocks were lost; therefore, the producer loss is shown by the number depopulated and the lost egg production.

The timing and location of the 1983-84 outbreak added to the market's response to the reduced supply. Although the psychology of the market cannot be measured, it is likely that the quarantine and eradication program alleviated fears of a serious product shortage. One could expect a greater market reaction in the absence of an eradication program.

Fewer than 4 million broilers were depopulated, only about 0.3 percent of the number slaughtered for market during November-April. Because of the bunching of the depopulation in November-December and the market overreaction, the AI-induced price rise may have been somewhat greater than the 1.2 cents per pound at wholesale as generated by the FAPSIM model, which would mean 1.5 cents at retail. At that rate, consumers paid $80 million more for broilers because of the disease (table 9).

The egg industry experienced the brunt of the 1983-84 AI outbreak for the reasons discussed previously, and because a greater proportion of layers was stricken. The 6-month impact of AI likely raised the price of eggs about 5 cents at retail (table 9). This was in response to a 23-million dozen decrease in eggs available to consumers. However, there was a rapid rebuilding of flock numbers, so the higher prices did not last.

Overall Effect of Actual 1983-84 Outbreak

Producers suffered direct losses of about $55 million, mostly from loss of eggs and layers (table 10). During the November-April period, about 8 million layers, 4 million broilers, and nearly 1 million turkeys were depopulated because of AI. By the time the program ended, 12 million layers and pullets were depopulated. A number of these were under observation for some time; therefore, this 12 million was used in the comparison, representing a direct loss of $22 million. Producers also lost $25 million in costs they had committed to egg production (half the production cost for 96 million dozen eggs, which was the estimated loss suffered by affected producers). The 4-million broilers depopulated represented a direct loss of $3 million and the million turkeys about $5 million, bringing the total direct loss by affected producers to $55 million (gross, before indemnities). A comparison of direct losses and extra costs because of AI under the three scenarios is shown in table 10.

AI reduced the supply of poultry products available for marketing, yet there was no definite shortage of product other than fowl. Storage stocks of eggs, chicken, and turkey were drawn down quickly. It is estimated that, in

Table 9.--Estimated aggregate 6-month impact of three scenarios of avian influenza, November 1983-April 1984

Quantity	Annual level 1983	Actual 1983 outbreak quarantine area			Actual area plus Delmarva Peninsula			Widespread Eastern United States		
		Change 1/		Increase in: costs 2/	Expected change 1/:		Increase in: costs 2/	Expected change 1/:		Increase in costs 2/
		Percent	Unit	$ Mil.	Percent	Unit	$ Mil.	Percent	Unit	
Eggs (mil. doz.)	5,655	- 0.8	-23		-0.9	-26		-14.5	-410	
Mature chicken slaughter (mil. hd.)	178									
(mil. lbs. RTC)	501	-11.2	-28		-12.4	-31		-33.3	-83	
Broilers slaughtered (mil hd.)	4,133									
(mil. lbs. RTC)	12,389	-.3	-18		-1.1	-67		-20.1	-1,245	
Turkeys slaughtered (mil. hd.)	165									
(mil. lbs. RTC)	2,563	- 1.2	-16		-1.2	-16		-3.8	-49	
Pork (mil. lbs., retail weight)	15,061									
Beef (mil. lbs., retail weight)	18,286									
	Cents	Percent	Cents	$ Mil.	Percent	Cents	$ Mil.	Percent	Cents	$ Mil.
Eggs, per dozen, wholesale	75.2	+ 6.0	+ 4.5	110	+6.8	+ 5.1	120	+48.3	+36.3	548
Eggs, per dozen, retail	92.1	3/+ 5.4	+ 5.0	120	3/+6.1	+ 5.6	133	+44.0	+40.5	602
Broilers, per pound, wholesale	49.4	+ 2.4	+ 1.2	65	+4.6	+ 2.3	102	+75.9	+37.5	1,080
Broilers, per pound, retail	72.8	+ 2.0	+ 1.5	80	+3.4	+ 2.8	124	+60.4	+44.0	1,271
Turkey, per pound, wholesale	60.5	+ 2.9	+ 1.7	11	+3.2	+ 1.9	12	+33.8	+20.4	222
Turkey, per pound, retail	91.7	+ 2.3	+ 2.1	13	+2.5	+ 2.3	14	+26.8	+24.6	258
Mature chicken, per pound, wholesale	50.9	+22.0	+11.2	11	+24.7	+12.6	12	+81.7	+41.6	23
Mature chicken, per pound, retail	72.8	+20.0	+14.6	12	+22.5	+16.4	13	+73.5	+53.5	29
Pork, per pound retail	169.8	+.5	+.8	60	+.8	+1.3	98	+13.6	+23.0	1,732
Beef, per pound retail	238.1	+.3	+.7	64	+.5	+1.2	110	+ 7.7	+18.3	1,673
Total, retail				349			492			5,565

1/ Expected change during 6 months from base of 1983 annual rate because of AI. 2/ Increase in cost is expressed in aggregate for United States in terms of millions of dollars, total. Based upon FAPSIM (Food and Agriculture Policy Simulator Model) comparisons. Quantity reductions due to AI were made exogenously in the model, with export and military use held constant; adjustments by consumers were simulated in quantity and prices. 3/ FAPSIM result was adjusted 3 percentage points because critical timing and location of outbreak resulted in greater than normal price response.

aggregate, the egg supply was reduced 23 million dozen, fowl meat by 28 million pounds, broilers by 18 million pounds and turkeys by 16 million pounds. The total net reduction was estimated at 62 million pounds of poultry meat (table 9). The combined price effect of this decrease is estimated to have caused consumers to spend an additional $225 million for poultry products during the 6-month period: $120 million for eggs and $105 million for chicken and turkey. Consumers also paid slightly higher (0.5 percent) prices for pork, raising those expenditures approximately $60 million. Beef prices were bid up about 0.3 percent, raising expenditures approximately $65 million.

The Federal Government spent over $60 million to eradicate AI. Over $40 million was paid to producers as indemnity for birds depopulated and materials destroyed. These payments helped offset the $55 million of producers' losses and improved their ability to rebuild their flocks. Part of the expenditures for salaries, travel, rent, and materials was spent locally, thereby offsetting some of the indirect losses in the community. Some part of the losses may be recovered through the loss recovery provisions of the tax code.

Potential Aggregate Impact of AI Spreading to Include Quarantine Area Plus Delmarva Peninsula

Had the 1983 outbreak spread to include the area actually quarantined plus the Delmarva Peninsula, the potential damage would have been considerably greater. The number of layers and turkeys at risk would have increased only marginally, but the number of broilers at risk would have almost quadrupled. The number of infected farms would have been greater. The area under quarantine would have increased and the threat of the disease spreading to other major areas would have been greater.

Assuming the disease and expanded eradication program comparable to that actually experienced, an AI outbreak that included the area of the 1983-84 quarantine plus the Delmarva Peninsula would have caused consumers to spend $492 million above normal expenditures for animal protein foods during November-April (tables 9 and 10). The major increase would have been $133 million more for eggs, and $124 million higher expenditures for broilers, the result of encompassing two major broiler producing areas. Other chicken would have cost an extra $13 million, and turkey an additional $14 million, making a total increase in expenditures of $284 million for poultry products. Pork prices also would have been bid up by 1.3 cents per pound, causing expenditures to rise by about $98 million. A 1.2-cent increase in retail price of beef would have added $110 million to consumers' food bill.

Potential 6-Month Effect of Widespread AI Outbreak

The rapidity with which the disease spread after highly pathogenic AI became apparent gives some indication as to how a widespread outbreak might progress. A widespread outbreak could quickly strain the resources available to conduct an eradication program. Without a Federal eradication program, it was assumed that AI would quickly spread throughout the Eastern United States. For this purpose, Eastern United States includes all States, except Wisconsin, east of the Mississippi River, plus Arkansas. There is no real barrier at that point, but movement and interaction within this area would make it unlikely that the outbreak would stop before it spread that far. Beyond that, it would likely spread to include the entire United States, but the time period may be longer.

Table 10.--Comparison of estimated direct losses by area producers and extra aggregate cost to consumers and Federal Government because of AI under three scenarios, November 1983-April 1984 1/ 2/

Item	Actual quarantine area		Actual area plus Delmarva Peninsula		Widespread outbreak Eastern United States	
	Mil. units	$ Mil.	Mil. units	$ Mil.	Mil. units	$ Mil.
Direct losses by producers:		55		70		508
Eggs	3/96	25	3/112	29	3/410	107
Layers	4/12	22	14	26	38	76
Broilers	4	3	13	10	412	309
Turkeys	1	5	1	5	3	16
Extra costs to consumers: 5/		349		492		5,645
Eggs		120		133		602
Fowl		12		13		29
Broilers		80		124		1,271
Turkeys		13		14		338
Pork		60		98		1,732
Beef		64		110		1,673
Cost of Government program:		54.7		69.7		0
Indemnities		38.1		48.5		0
Other costs		16.6		21.1		0

1/ Federal eradication program lasted from November 1983 through September 1984. Assumed no Federal eradication program with widespread outbreak. 2/ Consumer costs increased at the aggregate level, while producers' losses were at the specific individual level. Producer losses are gross direct losses, which are offset by the indemnities paid to the producers by the Government. Adjustments by those outside the area offset part of the direct volume loss borne by affected producers for scenarios 1 and 2. Adjustment potential would be severely limited under a widespread outbreak; therefore, aggregate and direct volume losses are considered equal under that scenario. 3/ Dozens. 4/ Only 8 million were depopulated during the 6-month period, but a large number were under observation, so the final total of 12 million was used. 5/ From table 9.

Other assumptions include:

- o No Federal control program
- o Interstate embargoes against affected production areas
- o No vaccination program
- o 60 percent of susceptible commercial flocks would be infected
- o 30 percent of replacements would be reinfected
- o 50 percent of infected flocks would be infected with the lethal strain
- o 50-percent mortality from the lethal strain (15 percent for turkeys)
- o 15-percent mortality from less virulent strain (2 percent for turkeys)
- o Egg production reduced by 20 percent during first month of infection and by 10 percent for those recovering
- o Some birds marketed at lighter weights
- o Birds grow more slowly, requiring longer to reach market weight
- o Extra feed required per pound of gain
- o Historic quantity-price relationships would prevail

Potential 6-Month Losses to Egg Producers

A widespread AI outbreak would inflict heavy losses on egg producers through bird mortality and reduced egg production from recovered hens. Producers in the eastern half of the country have 63.3 percent of the Nation's laying flock, so about 12.3 percent of all hens would be lost. Mortality losses could reach 38.2 million hens and pullets.

Producers would not automatically dispose of infected flocks as they did under the eradication program. Each producer would have to decide whether to dispose of the flock and replace with started pullets or to maintain the part of the flock that survived through the remainder of their lay cycle. Keeping the flock would mean a reduced number of hens in the flock because of the mortality suffered. They would not add started pullets to a flock that had recovered from AI.

Higher egg prices resulting from the decrease in production probably would encourage most producers to maintain their recovered flocks even though the numbers were depleted. We assume that 20 percent of the producers would dispose of their stricken flocks and replace them with started pullets, reducing the egg supply another 2 percent. However, about 30 percent of the replacements would be expected to become infected, thereby increasing replacement costs and further decreasing the supply of eggs available. Producers holding older flocks in production likely would offset the loss from infected replacement flocks plus increase the U.S. flock by 2 percent.

The net reduction in the 6-month supply of eggs available would be 410 million dozen, or 14.5 percent (-12.3 from mortality, -2.2 from reduced productivity of recovered birds, + 2 from holding older hens, -2 from disposal of flocks = 14.5 percent of 6-month egg production).

Other loss items include: feed, clean up, loss of markets, transportation, and replacements. These losses are not assigned a dollar value in this analysis, although they were substantial for individuals.

Potential 6-Month Losses to Broiler Producers

Even though broiler production is more geographically concentrated, the same general assumptions regarding incidence and mortality were applied to broilers as to egg producers in the case of a widespread outbreak. Producers would sustain direct losses from bird mortality and lighter weight birds.

Over 85 percent of the broilers are produced in the eastern half of the country. Without an eradication program, mortality losses from a widespread AI outbreak in this area would be expected to run about 340 million birds, about 16.6 percent of the Nation's regular 6-month broiler production.

Although producers would likely dispose of a majority of broods of young birds that suffered severe symptoms, they were not counted as a total loss. It was assumed those not dying from AI would recover and be marketed at 10 percent lighter weight. This would be equivalent to 72 million birds, or about 3.5 percent of the 6-month U.S. broiler production.

The 6-month broiler supply would be reduced by 20.1 percent or 412 million birds (340 million from mortality and 72 million from light weight). Supply would also be reduced by the downtime due to cleanout and disinfecting of premises. This factor is not measured in this analysis because it would be so variable without a formal Government program. Producers in locations not infected would tend to expand production, but this adjustment is not quantified as it would be quite limited in case of such a widespread outbreak.

Potential 6-Month Losses To Turkey Producers

General assumptions listed under egg production were also applied to turkeys. Turkey production is very heavily concentrated in rather small areas. The Eastern United States produces about 46.8 percent of the U.S. total.

AI does not affect turkeys so adversely as it does chickens. Producers could expect a death loss of about 2 million head, or 2.4 percent of the regular U.S. turkey production. Turkeys recovering from AI would average about 5 percent below normal weight at marketing, equivalent to the loss of another 1.1 million birds. These two factors would reduce the 6-month turkey supply by 3.1 million birds, about 3.8 percent of the normal turkey crop.

Downtime would also reduce the turkey supply, but this factor is not quantified because of extreme variability. The net effect of producers expanding output where they were not hit by AI was not measured.

Overall 6-Month Losses to Producers from Widespread AI Outbreak

Had AI become widespread throughout the Eastern United States, affected producers could have sustained direct production cost losses of $507.5 million. Hens and pullets would have represented a loss of $76.4 million (38.2 million hens and pullets at $2 each). These producers would also have lost about 410 million dozen eggs for which half the production costs had already been incurred (410 million dozen at 26¢ = $106.6 million loss). An estimated 412 million broilers costing $309 million would have been lost (412 million at 75¢ each). Approximately 3.1 million turkeys, at $5 each, would have been a loss of $15.5 million.

These are direct production costs which would have been lost to producers over a 6-month period due to a widespread AI outbreak. Losses not shown include such items as increased marketing costs, loss of markets (both domestic and foreign), extra sanitation and cleanout, extra transportation, inefficiency in use of labor and facilities, lost income, loss of breeder stock, losses on goods purchased to meet commitments, and losses due to inability to meet financial commitments. Additional detail is presented in the section on local community impacts.

Shortrun Impact of Widespread AI Outbreak Upon Consumers

Consumers would feel the impact of a widespread outbreak of AI in three major ways: (1) a smaller quantity of poultry products, (2) higher prices for poultry products, and (3) higher prices for other meats.

U.S. consumers have never experienced a rapid decrease in the supply of poultry meat such as could result from a widespread AI outbreak. Such a dramatic reduction in quantities available could cause greater increases in prices and expenditures than those estimated through the use of historical relationships. Consumers, trying to adjust food consumption and expenditures, quite likely would bid up the price of beef and pork more than shown based upon past substitution relationships. Market disruption would also be a factor, adding to the normal consumer reaction to smaller changes in supply. Prices would be bid up by retailers, institutional users, and consumers, allocating the scarce supplies.

As previously shown, the expected decrease in 6-month supplies of poultry products from a widespread AI outbreak in the Eastern United States would be: broilers 20.1 percent, turkeys 3.8 percent, fowl meat 33.3 percent, and eggs 14.5 percent (table 9).

This would be a drop of about 1,245 million pounds of RTC broilers, 49 million pounds of RTC turkey, and 83 million pounds of RTC fowl meat: a total of 1,377 million pounds of poultry meat. This is equivalent to 5.8 fewer pounds of meat per person during the 6 months, probably the most precipitous drop ever in total meat supplies. In this case, the decline would all be in poultry.

Based upon the prices generated by FAPISM, consumers would pay approximately $2.2 billion more for the reduced quantities of poultry products during the 6 months (tables 9 and 10). Retail prices would rise about 44 cents for broilers, 25 cents for turkeys, 54 cents for other chicken, and 40 cents for eggs.

ADDITIONAL IMPACTS AND COSTS OF AVIAN INFLUENZA

Economic impacts are usually measured mostly as changes in price and quantity of products. However, on a local basis, the impact of a disease outbreak such as AI may take many forms. For example, layer operations were most likely to be affected in Pennsylvania, while in Virginia the problem was mostly with turkeys. Individual producers fare quite differently. A producer with several growers may have only a small part of the flocks infected while another may lose a high portion of birds. Individual growers may be hardest hit as they generally have all their birds at a single location and must close

down for a period following flock depopulation. During this period, income stops completely and expenses for cleanup increase.

Besides losing part of its local sales, a hatchery selling chicks, poults, or eggs beyond the local area loses that part of its market when quarantined. Feed mills, processing plants, and other suppliers lose part of their volume, forcing unit costs up and income down. There are extra cleanup and disinfecting costs facing all sectors. Normal movements through market channels are badly disrupted. Losses are most severe to producers with high payment obligations, such as for facilities. Cash flow obligations become very difficult to meet at a time when additional expenses are being incurred and incomes have been curtailed. The quarantine and eradication program may have had a greater adverse impact for specific individuals than the disease itself. Specific producers and contract growers whose flocks quickly recovered from a mild case of AI may have fared better in the short run without the program.

Producer Losses by Source

The Pennsylvania poultry industry tends to be a mix of highly integrated complexes and independent operations. The economic cost to the individuals concerned is quite different for the different enterprises. Even with a given brood of broilers, the proportion of total cost varies between the producer and contract grower as the birds grow.

The Pennsylvania quarantine area is used to illustrate an allocation of costs and some of the economic losses. Costs are intended to represent total production costs, but the indirect losses are only a part of those suffered by the industry and community.

The production costs are similar to those used to establish indemnity values, but are not identical. They were estimated separately for different periods of time, with somewhat different assumptions, and for different areas. These estimates of costs are presented to illustrate which costs of production are borne by the integrator and which by the contract grower, and how both level and proportion change during a production cycle.

Estimates of broiler production costs are shown by week and source in tables 11 and 12. The estimates are based upon an operation producing 10,000 broilers at 8 weeks of age. Cumulative costs are shown for each 1,000 surviving birds through each week. In this illustration, fixed costs for building and equipment were allocated fully at the time the broilers were placed in the building. This allocation recognizes that the contract grower had committed the house, and therefore the costs, to that brood. Almost all that cost was sunk at that time. Fuel, litter, and labor costs were either fully or heavily committed very early in the production cycle. The contract grower bears a very high proportion of the costs very early in the cycle, but receives income only upon delivery of product.

The integrator has early costs for chicks, litter, part of the fuel, medication, and placement labor. Feed costs are heaviest during the latter part of the growout period.

If a brood of 10,000 broilers were depopulated at the end of the second week, the grower would have incurred approximately $1,750 - $1,800, or about 85 percent of the grower's cost of $2,000 - $2,100 during the full 8-week cycle.

The integrator, on the other hand, would bear approximately $3,000 or only one-fourth of the $12,000 total during a full cycle. The severity of the economic loss to the individual, especially the integrator, varies with the stage of the production cycle.

Production costs are summarized for hen turkeys by week and source in table 13. The previous comments regarding distribution of costs apply also to turkeys except the grower has an extra labor cost for moving poults to the growout house at 6-7 weeks of age. Fuel is used for brooding, with heaviest use during the first 4 weeks. Litter is put down before the poults are placed. Much of the labor is used preparing the house and in brooding. Major costs for the integrator are at the start for day-old poults and for feed which is mostly in the last half of the period.

Although time of depopulation is critical for egg producers, costs for producing commercial eggs follow a different pattern than for broilers and turkeys. Assuming that 20-week-old started pullets are purchased, there is both a flow of expense and revenue. Feed consumption continues at a fairly steady rate throughout the laying cycle, as does the need for labor and electricity. Again, housing costs are committed when the pullets are placed (table 14). Both integrator and grower begin to receive income from egg sales almost immediately after pullets are placed in the laying house. Current revenue normally begins to exceed current costs after about a month. This revenue in effect continues to reduce the net cost situation for integrator and grower so that each has less net cost in a flock nearing the end of the lay cycle than at the beginning. The hen is also depreciating in value during the cycle so that if sold, she goes as a spent hen. Under most contracts, payment for eggs represents the only income for contract growers, raising an allocation problem for purposes of sharing the indemnity payments.

The AI outbreak caused producers to incur costs not included in the regular production costs. These indirect costs include extra cleanup and disinfecting (labor and materials), extra transportation, loss of feed, loss of markets, extra cost of servicing markets, extra credit costs, heavier mortality, and lower productivity of affected birds. Heavy losses may also be suffered because of downtime, operating much below capacity, and inability to meet financial obligations because of loss of income. Some of these are illustrated for broilers in appendix 4.

Community Effects

Affected communities also suffered direct and indirect economic losses from AI. Processing and feed plants operated far below capacity, leading to higher unit costs and reduced income. Hatcheries reduced volumes and lost business because they were unable to ship live birds out of the quarantine area. As processing plants, feed mills, hatcheries, and other businesses lost volume and suffered disruption, reduced employment further affected the community.

Local effects of AI tend to be proportionally much greater than the aggregate whether or not there is an eradication program. The reduction caused by disease was concentrated within a relatively small area while industry adjustments were widespread. Commercial layers provide the most dramatic example. The entire quarantined area had a 1982 inventory of 17.9 million hens and pullets of laying age, with 16.1 million of these reported by the area in Pennsylvania. The 8 million plus layers and pullets depopulated in November-April represented about half the total inventory at a given time in

Table 11.--Estimates of broiler production cost per 1,000 birds by week and source, December 1983

Week	Birds on hand end of week	Chick cost cum.	Feed used, end of week: Week	Feed used, end of week: Cum.	Feed cost, end of week cum.	Litter cost, cum.	Labor, cum.		Fuel, cum.	
	No.	Dollars	Pounds		Dollars		Hrs.	Dol.	Gal.	Dol.
0	10,400	167.00	0	0	0	15.00	14.0	42.00		
1	10,350	167.81	350	350	39.90	15.07	15.6	46.80	13.4	10.18
2	10,300	168.62	590	940	107.16	15.15	17.2	51.60	23.0	17.48
3	10,250	169.49	790	1,730	197.20	15.22	17.6	52.80	30.6	23.26
4	10,200	170.27	950	2,680	303.13	15.29	18.0	54.00	31.8	24.17
5	10,150	171.11	1,390	4,070	458.11	15.37	18.4	55.20	32.9	25.00
6	10,100	171.96	1,690	7,630	646.55	15.45	18.8	56.40	34.0	25.84
7	10,050	172.82	1,880	7,630	856.17	15.52	19.2	57.60	34.0	25.84
8	10,000	173.68	1,550	9,130	1,023.42	15.60	19.6	58.80	34.0	25.84

Week	Depreciation, cum.	Interest, cum.	Ins, tax, rep. misc., cum.	Elect., cum.		Misc. cost, cum. (C)
	Dollars			kWh	Dollars	
0	48.18	33.73	28.65			
1	48.41	33.89	28.99	6.5	0.42	2.50
2	48.65	34.06	29.13	19.5	1.28	5.00
3	48.89	34.22	29.26	45.5	2.96	7.50
4	49.13	34.39	29.41	78.0	5.07	10.00
5	49.37	34.56	29.56	110.5	7.18	12.50
6	49.61	34.73	29.70	136.5	8.87	15.00
7	49.87	34.91	29.85	149.5	9.72	17.50
8	50.11	35.08	30.00	162.5	10.56	20.00

C = contrator; G = grower.
Source: EKS estimates based upon past studies. Costs allocated and cumulative by week per 1,000 live birds at end of each week.

Table 12.--Summary of estimates of broiler production costs by age and source, December 1983

Item	Age in weeks								
	0	1	2	3	4	5	6	7	8
	Dollars per 1,000 broilers, cumulative								
Chick	167.00	167.81	168.62	169.49	170.27	171.11	171.96	172.82	173.68
Feed	0	39.90	107.16	197.20	303.13	458.11	646.55	856.17	1,023.45
Litter	15.00	15.07	15.15	15.22	15.29	15.37	15.45	15.52	15.60
Fuel	0	10.18	17.48	23.26	24.17	25.00	25.84	25.84	25.84
Miscellanous (C)	0	2.50	5.00	7.50	10.00	12.50	15.00	17.50	20.00
Total (C)	182.00	235.46	313.41	412.67	522.86	682.09	874.80	1,087.85	1,258.57
Deprecation	48.18	48.41	48.65	48.89	49.13	49.37	49.61	49.87	50.11
Interest	33.73	33.89	34.06	34.22	34.39	34.56	34.73	34.91	35.08
Electricity	0	.42	1.28	2.96	5.07	7.18	8.87	9.72	10.56
Miscellanous (G)	28.65	28.99	29.13	29.26	29.41	29.56	29.70	29.85	30.00
Total (G)	110.56	111.71	113.12	115.33	118.00	120.67	122.91	124.35	125.75
Labor	42.00	46.80	51.60	52.80	54.00	55.20	56.40	57.60	58.80
Total (G1)	152.56	158.51	164.72	168.13	172.00	175.87	179.31	181.95	184.55
Total	334.56	393.97	478.13	580.80	694.86	857.96	1,054.11	1,269.80	1,443.12

G = grower; C = contractor; G1 = grower's total costs, including labor.
Source: ERS estimates based upon past studies.

Table 13.--Summary of turkey hen production costs per 1,000 birds cumulative to end of week within flock production period by source, December 1983

Age in weeks	Birds on hand end of week	Poult cost	Feed used	Litter used	Labor used		Fuel used	
	No.	Dollars	Lb.	- - - Dollars - - -		Hrs.	Dollars	Gal.	Dollars
0	10,752	930.00	0	0	29.25	16.8	50.40	0	0
1	10,698	934.69	140	17.36	29.40	20.3	60.90	62.7	47.65
2	10,644	938.50	420	52.08	29.55	22.8	68.40	117.9	89.61
3	10,590	944.23	980	121.52	29.70	24.8	74.40	165.4	125.70
4	10,536	949.07	1,930	239.32	29.85	25.8	77.40	205.2	155.95
5	10,482	953.96	3,460	429.04	30.00	26.8	80.40	237.2	180.27
6	10,428	958.89	5,550	688.20	30.16	37.3	111.90	246.5	187.34
7	10,375	963.79	7,640	947.36	30.31	49.8	149.40	255.8	194.41
8	10,322	968.74	9,950	1,233.80	30.47	50.8	152.40	265.2	201.55
9	10,286	972.12	12,150	1,506.60	30.58	52.8	158.40	266.1	202.24
10	10,250	975.54	14,790	1,833.96	30.68	53.8	161.40	267.1	203.00
11	10,214	978.98	17,430	2,161.32	30.79	54.8	164.40	268.0	203.68
12	10,178	982.44	20,790	2,577.96	30.90	55.8	167.40	269.0	204.44
13	10,142	985.94	23,990	2,974.76	31.01	56.8	170.40	269.9	205.12
14	10,106	989.35	27,490	3,408.76	31.12	57.8	173.40	270.9	205.88
15	10,070	992.98	31,000	3,844.00	31.23	58.8	176.40	271.8	206.57
16	10,030	996.35	34,520	4,280.48	31.36	59.8	179.40	272.9	207.40
17	10,000	999.94	38,720	4,801.28	31.45	60.8	182.40	273.7	208.01

Age in weeks	Depr. cost	Interest cost	Other costs		Total cost		Total
			G	C	G	C	
	Dollars						
0	205.66	143.96	123.40	30.00	523.42	989.25	1,512.67
1	206.71	144.69	124.03	45.00	536.33	1,074.16	1,610.43
2	207.74	145.42	124.64	60.00	546.20	1,169.74	1,715.94
3	208.81	146.16	125.29	75.00	554.56	1,296.15	1,850.71
4	209.87	146.91	125.92	90.00	560.10	1,464.19	2,024.29
5	210.96	147.67	126.58	105.00	565.61	1,698.27	2,263.88
6	212.05	148.43	127.43	120.00	599.61	1,984.55	2,584.20
7	213.13	149.19	127.88	135.00	639.60	2,270.87	2,910.47
8	214.23	149.96	128.54	150.00	645.13	2,584.56	3,229.69
9	214.97	150.48	128.98	155.00	652.83	2,886.55	3,519.38
10	215.73	151.01	129.44	160.00	657.58	3,203.18	3,860.76
11	216.49	151.54	129.89	165.00	662.32	3,539.77	4,202.09
12	217.25	152.08	130.35	170.00	667.08	3,965.74	4,632.82
13	218.03	152.62	130.82	175.00	671.87	4,371.83	5,043.70
14	218.81	153.16	131.29	180.00	676.66	4,815.11	5,491.77
15	219.59	153.71	131.75	185.00	681.45	5,259.78	5,941.23
16	220.46	154.33	132.28	190.00	686.47	5,705.59	6,392.06
17	221.13	154.79	132.68	195.00	691.00	6,235.68	6,926.68

G = grower; C = contractor.

Source: ERS estimates based upon past studies. Costs allocated and cumulative by week per 1,000 live birds at end of each week.

Table 14.--Estimates of table egg layer costs per 1,000 layers by source and by stage, cumulative to end of each 4-week production period, December 1983

Age in weeks	Layers on hand end of period	Pullet cost	Feed used		Other costs		Electricity		Labor used		Depr. cost	Interest cost
	No.	Dollars	Lb.	Dollars			kWh.	Dollars	Hr.	Dollars		
21	11,111	2,650.00	0	0	35.00	116.67	0	0	2.0	6.00	466.67	490.00
22-25	11,026	2,670.43	5,470	601.70	48.00	117.57	230	14.95	8.6	25.80	470.26	493.78
26-29	10,940	2,691.42	12,227	1,344.97	61.00	118.49	40	29.90	15.2	45.60	473.96	497.66
30-33	10,855	2,712.50	19,079	2,098.69	74.00	119.42	690	44.85	21.8	65.40	477.67	501.56
34-37	10,769	2,734.16	25,823	2,840.53	87.00	120.37	920	59.80	28.4	85.20	481.49	505.56
38-41	10,684	2,755.91	32,412	3,565.32	100.00	121.33	1,150	74.75	35.0	105.00	485.32	509.58
42-45	10,598	2,778.27	38,876	4,276.36	113.00	122.32	1,380	89.70	41.6	124.80	489.26	513.72
46-49	10,513	2,800.74	45,228	4,975.08	126.00	123.30	1,610	104.65	48.2	144.60	493.21	517.87
50-53	10,427	2,823.84	51,435	5,657.85	139.00	124.32	1,840	119.60	54.8	164.40	497.28	522.14
54-57	10,342	2,847.05	57,439	6,318.29	152.00	125.34	2,070	134.55	61.4	184.20	501.37	526.43
58-61	10,256	2,871.82	63,235	6,955.85	165.00	126.39	2,300	149.50	68.0	204.00	505.57	530.85
62-65	10,171	2,894.91	68,893	7,578.23	178.00	127.45	2,530	164.45	74.6	223.80	509.79	535.29
66-69	10,085	2,919.60	74,319	8,175.09	191.00	128.54	2,760	179.40	81.2	243.40	514.14	539.85
70-73	10,000	2,944.42	79,509	8,745.99	204.00	129.63	2,990	194.35	87.8	263.40	518.51	544.44

Age in weeks	Total cost	Return for eggs produced		Net cost	Total cost C-1	Grower payment	Net cost C	Total cost G	Net cost G
	Dollars	Doz.		Dollars					
21	3,764.34	0	0	3,764.34	2,685.00	0	2,685.00	1,079.34	1,079.34
22-25	4,442.49	896	537.60	3,904.89	3,320.13	67.20	2,849.73	1,122.36	1,055.16
26-29	5,263.00	2,841	1,704.60	3,558.40	4,097.39	213.08	2,605.87	1,165.61	952.53
30-33	6,094.05	4,875	2,925.00	3,169.05	4,885.19	365.63	2,325.82	1,208.86	843.23
34-37	6,914.11	6,839	4,103.40	2,810.71	5,661.69	512.93	2,071.22	1,252.42	739.49
38-41	7,717.21	8,734	5,240.40	2,476.81	6,421.23	655.05	1,835.88	1,295.98	640.43
42-45	8,507.43	10,557	6,334.20	2,173.23	7,167.63	791.78	1,625.21	1,339.80	548.02
46-49	9,285.45	12,312	7,387.20	1,898.25	7,901.82	923.40	1,438.02	1,383.63	460.23
50-53	10,058.43	13,997	8,398.20	1,660.23	8,620.69	1,049.78	1,272.27	1,437.74	387.96
54-57	10,789.23	15,614	9,368.40	1,420.69	9,317.34	1,171.05	1,119.99	1,471.89	300.84
58-61	11,509.08	17,164	10,298.40	1,210.68	9,992.77	1,287.30	981.67	1,516.31	229.01
62-65	12,211.92	18,648	11,188.80	1,023.12	10,651.14	1,398.60	860.94	1,560.78	162.18
66-69	12,891.22	20,066	12,039.60	851.62	11,285.69	1,504.95	751.04	1,605.53	100.58
70-73	13,544.74	21,422	12,853.20	691.54	11,984.41	1,606.65	647.86	1,650.33	43.68

G = grower; C = contractor; C-1 = contractor costs less grower fee.
Source: ERS estimates based upon past studies. Costs allocated and cumulative by period per 1,000 live birds at end of each period.

the Pennsylvania area. Although this area is a major supply area, the number depopulated was only a small part of the national inventory. Producers outside the quarantine area were receiving substantially higher prices and responded by holding old hens longer, even increasing the layer inventory. Egg packers had to replace the production lost in Pennsylvania with eggs shipped from other areas. Smaller, but similar, losses were encountered by local broiler and turkey businesses.

Indemnity Values

The law provides for an eradication program and for indemnifying producers when their livestock or poultry must be depopulated in order to eradicate a disease.

Indemnity payments assist producers, processors, and community by offsetting part of the losses. Such payment also helps secure industry and community cooperation. As is the usual pattern in such instances, when it became evident the State resources were not adequate to eradicate the 1983-84 outbreak, State and local officials, industry leaders, processors, integrators, and producers requested the Federal Government to activate an eradication program. The request was supported by the industry from other production areas and by officials from other States.

USDA based the fair market indemnity values upon the cost of producing the bird or egg. These values include total production costs for an independent producer or for both the contractor-owner and the contract grower. Regular markets for chickens are for day-old chicks, broiler-fryers, started pullets, and spent hens. There are no established markets or prices for chickens (or turkeys) at other stages of development. An indemnity value was determined for birds at each week of age based upon costs of rearing the bird to those stages in the life cycle. An exception was made for commercial egg layers because egg producers often purchase started pullets to replace older hens, and consider this purchase cost rather than cost of rearing as a normal cost of producing eggs.

The U.S. cost-returns series for eggs, broilers, and turkeys published by ERS in the Livestock and Poultry Outlook and Situation report was used as the base for cost estimates. ERS used data from the poultry industry in Pennsylvania, Virginia, and other areas, and from several experiment stations, to adjust production costs to reflect the higher than average costs in the quarantine area for housing, feed, labor, and fuel. Indemnity values were set to pay the estimated total costs of production for producers in the area. Profits, foregone profits, and downtime were not included in the estimates nor in the indemnity values.

Indemnity values were revised for commercial layers, broilers, and turkeys on March 29, 1984, to reflect higher costs and the disrupted market for started pullets. The increased indemnity rates were retroactive to the beginning of the eradication program. Revised values for broilers and market turkeys are shown below in tables 15 and 16. Details are shown for broilers to illustrate the method utilized in each case.

USDA originally based the indemnity value for commercial layers on the cost of purchasing a started pullet at 20 weeks of age. This value was about 10 cents higher than the cost of raising a pullet at that time, but was considered appropriate because egg producers often purchase started pullets. After about

27 weeks of age, income from egg sales should exceed current expenses so that net cost in the hen is reduced each week. The hen is also depreciating in value as a source of income and in sale value, so indemnity value was steadily reduced to a minimum of $0.92 as a spent hen. If the hen is force molted and kept through a second laying cycle, she requires about 2 months of care and feed while in the molt, during which time she is not laying. At that time, cost and value of the hen have both gone up. Following molt, the hen was again depreciated to a minimum of $0.92. As long as she is in the laying flock, the hen is considered more valuable as a layer than for sale as a spent hen.

Because of the complete disruption of the started pullet market in the quarantine area and severe hardship among those egg producers, it was necessary to revise the method of determining indemnity values for layers. Since there was no effective market, revised layer values were determined by considering the capitalized cost of the layer until she could be replaced (26 weeks). This method determined the value at which a producer could afford to buy or sell a layer, considering the potential income flow and expenses during the 26 weeks and the value of a spent hen at the end of that period. It was assumed that producers had placed those hens based on their expectation of egg prices as projected in the December issue of the Livestock and Poultry Outlook and Situation report. This gave a value 33 percent higher than the previously used cost of production base for a hen 27 weeks of age. The entire schedule for layers was increased by this 33 percent. Pullet values were likewise increased by 16.5 percent, based on capitalized cost for a started pullet. Values for weeks 18, 19, and 20 were adjusted to bridge the difference between pullets and hens more smoothly (see app. 5).

Table 15.--Revised indemnity values for broilers 1/

Age	Indemnity value per head
Weeks	Cents
1	32.96
2	43.54
3	55.36
4	71.12
5	92.28
6	117.36
7	138.25
8	164.00
9	191.00
10	221.00

1/ The following assumptions and cost factors (cents per broiler) were considered appropriate for producing a 7-week-old broiler in the quarantine area: chicks 20.05, litter 1.64, fuel .80, electricity 1.23; vet. etc., 1.28, service 3.65; miscellaneous .86; grower's fee 13.53, feed 94.76; total 138.25. Feed price = $226.59/ton. Feed conversion = 2.04. Live wt. @ 7 wks. = 4.1 pounds.

ECONOMIC IMPLICATIONS OF ERADICATION PROGRAM

Benefits of a disease eradication program come from limiting the impact of the disease. This benefit is shared by two primary groups: those whose flocks did not become infected and consumers. Likewise, two groups bear the primary burden: those whose flocks were depopulated because of the disease and taxpayers (through government expenditures). The burden and damage are highly visible, but the benefits are not. It is impossible to estimate precisely either the damage a disease outbreak causes, the damage avoided by limiting the outbreak, or the cost of eradicating a disease. One can, however, make meaningful estimates to provide guidance and direction.

Shortrun economic impacts of the 1983-84 AI outbreak were compared with estimates of what a widespread outbreak would likely have cost if the eradication program had not been put into effect. The difference between these two scenarios represents an estimate of benefits realized from the eradication program.

Table 16.--Revised per bird indemnity values for market turkeys

Age	Males	Females
	Dollars	
1	2.11	1.36
2	2.40	1.56
3	2.65	1.76
4	2.92	1.97
5	3.19	2.21
6	3.48	2.49
7	3.81	2.79
8	4.14	3.11
9	4.54	3.46
10	4.96	3.82
11	5.41	4.21
12	5.93	4.62
13	6.52	5.01
14	7.23	5.43
15	7.94	5.90
16	8.64	6.39
17	9.35	6.90
18	10.08	
19	10.83	
20	11.61	
21	12.40	
22	13.23	
23	14.10	
24	15.03	

An intermediate scenario assumes that despite the eradication program the disease spread beyond the actual quarantine area to also include the Delmarva Peninsula. The risk of AI spreading beyond the actual area and disrupting the efforts of the eradication program was very real. Any delay in implementing the program increased that risk.

Estimates of direct cost to consumers and Federal Government and direct producer losses for the three scenarios for the 6-month period November 1983 through April 1984 are shown in table 10. Producer loss estimates are limited to direct losses of poultry and eggs from AI; other losses of cleanup, disinfecting, transportation, income foregone, and financial hardships are not included. Direct producer losses were approximately $55 million gross (table 10) in the area quarantined as a result of the outbreak. The Federal Government paid over $40 million in indemnities to those producers, offsetting their losses by that amount. If the disease had spread to include the Delmarva Peninsula, producer losses would have risen another $15 million. Without an eradication program, a widespread AI outbreak would have caused producer losses reaching $508 million, nine times those suffered in the actual outbreak.

Consumers would have borne the greatest overall burden of a widespread outbreak. The sudden drop in poultry and egg supplies would have caused prices to rise, driving costs to consumers up $5.6 billion, 11 times the loss by producers. Likewise, consumers realized more of the benefits of the eradication program than did producers. Because the eradication program was successful, consumer costs rose only about $349 million (table 10). The Federal eradication program, at a cost of over $60 million, contained the outbreak and helped avoid further losses and potential increased costs of $5.8 billion ($5.3 billion more consumer costs + $0.5 billion more producer losses).

Longer Run Impacts

Athough this statement is made in terms of a 6-month period, AI will continue to affect indirectly the poultry industry for some time. Effects will be substantially lower because the eradication program shortened the duration of the outbreak and limited it to the quarantine area.

The limited scope of the AI outbreak permitted noninfected areas to expand production, somewhat offsetting the losses of poultry and eggs within the quarantine area. Embargoes by major importing countries precluded shipment of poultry from the affected area, but exports were made from noninfected areas. Without the eradication program, neither of these industry adjustments would have been so effective.

Producers almost immediately started adjusting so as to increase output in response to the higher prices resulting from decreased supplies. Forthcoming supply increases then drove prices down. AI suddenly shifted the industry into a disequilibrium position. The result will quite likely be a cyclical effect which will gradually dampen out to approximate a new equilibrium position. A larger area of infection would have had a more disruptive impact, giving a stronger and more extreme cycle pattern of prices and production.

It is not clear what the longer term effects of AI and the eradication program upon the structure of the industry will be. The industry may continue to enforce greater biosecurity measures to lower the likelihood of spreading diseases. Some producers are considering expanding the size of individual

growout units and their feed storage so that the feed truck would deliver a full load to a single unit. The truck would then be disinfected before going to another farm. This would argue for consolidation of growout facilities into fewer and larger units, and perhaps more direct ownership of such units by the integrator.

Others perceive the ease of disease transmission between closely adjacent buildings and are planning to establish smaller units located near each other but not adjacent to other poultry. Such a course would lead to more contract growers.

Policy and Program Implications

The value of an established coordinated Federal-State-industry program became obvious during the 1983-84 AI outbreak. The severity of the disease and the rapidity with which it developed and spread made swift, decisive action an absolute necessity. The existence of trained, preselected units of animal health specialists under APHIS auspices made it possible to move rapidly and efficiently to eradicate the disease. Delay would have been very costly and may have allowed the disease to spread to the extent that short-term eradication would not have been possible.

The main purpose of the eradication program was to protect the industry and consumers from a widespread occurrence of AI. Eradication provided the dominant guideline for all activities and decisions of the program. Effective eradication of such a highly communicable disease requires full cooperation of Federal-State-industry agencies and personnel. Individual producers cannot effectively protect their flocks, nor can consumers protect themselves from the adverse impacts of the disease.

A major part of the specific risk of a disease must be borne by the individual. Society can alleviate the distress caused by a disease by a transfer of funds or privilege to the affected individuals. Such a transfer is limited and is totally dependent upon the willingness of society, constrained by the knowledge that food supplies and prices are influenced by the extent to which the disease spreads. Response to a disease control program is tempered by the way the losses are shared. Although aggregate costs resulting from disease are greater for consumers than aggregate losses by producers, the cost to each consumer is relatively small, whereas a few producers suffer staggering individual losses.

In addition to a greater understanding of the specific disease, USDA, State, local, and industry personnel gained valuable experience in organizing and executing an effective eradication program. Two specific economic examples should be emphasized by this paper. USDA determines the indemnity values for animals depopulated because of a disease. This determination must be made before eradication can begin. In fact, cost estimates must be made before authority to proceed is granted by the Office of Management and Budget. Values set strongly influence the economic well-being of the individual producers. They also bear upon the effectiveness of the program.

Inappropriate values can generate ill will from the industry, the public, or policymakers, depending upon the error. Wrong values can also hinder the program by causing producers to either hesitate to cooperate--giving the disease more chance to spread--or by encouraging unnecessary depopulation when indemnity values are set too high.

The second example grows from the structure of the poultry industry. An integrator may own large numbers of birds located on several different farms where they are cared for by contract growers who provide the housing, equipment, labor, and some other inputs. USDA currently recognizes total production costs in determining the indemnity values, which are paid to the owner of the birds. There is no formal requirement or procedure for assuring that the indemnity is properly shared with the contract grower. If the contractor-owner does not pass on the proper amount to the grower, then the owner could be profiting from the indemnity payment and the grower could lose a disproportionate amount of the costs committed to production. Formalizing provisions to share the indemnity between those who had contributed to the production process would make indemnity valuation and program administration far more complex and increase the potential for delay and other distracting actions that could interfere with carrying out the eradication program. Still, equity and potentially large sums of money are involved and argue for considering the problem which will continue to grow as financial commitment and cost responsibility become more separated from ownership, whether it be poultry or other type of livestock.

The eradication program limited short-term producer losses and consumer cost increases to about 10 percent of what would have been suffered from a widespread outbreak. Government costs for indemnities and program administration represented only about 1 percent of the probable cost to producers and consumers of a widespread outbreak in the absence of such a program.

APPENDIX I

Procedure Manual for Management of Initial Outbreak of an Emergency Poultry Disease on Delmarva (prepared by the Delmarva Poultry Industry Poultry Disease Task Force).

I. Purpose of Task Force

To develop and implement plans to stop a threat or to control and/or eradicate emergency poultry diseases (EPD) that could result in serious economic losses to the commercial poultry industry on Delmarva. Such diseases include VVND, AI, Coryza, LT outbreaks with high mortality, etc.

II. ACTION TO BE TAKEN BY GROWER

A. Immediately telephone flock supervisor of suspicion.

III. SUPERVISOR IMMEDIATELY GIVES THIS FLOCK TOP PRIORITY

IV. PROCEDURE FOR HANDLING SUSPECT FARM PREMISES BY FLOCK SUPERVISOR

A. Have emergency kit in car.

B. Park vehicle well away from poultry house, preferably in a well graveled or grassed area.

C. Put on all wearing apparel (clean), disinfect boots and gloves immediately on arrival.

D. If an EPD is suspected by the supervisor, collect specimen for diagnosis and use recommended procedures:

1. Select live symptomatic or fresh dead birds. To prevent tearing of the bag, cut off beak and feet of dead birds at hock prior to putting these birds in the plastic bag and sealing it. Fluorescent antibody (FA) procedures require live birds. Suspect birds (dead or live) should be handled in such a manner as to minimize contamination from fecal matter or any other body exudates or feathers.
2. Tie off bag.
3. Disinfect bag and place in second plastic bag.
4. Disinfect second bag.
5. Put boots, gloves, coat, and hat in disinfectant and handle routinely.
6. Be careful to avoid contamination of vehicle.
7. Alert appropriate diagnostic laboratory and await instructions:

Maryland: Maryland Department of Agriculture
Animal Health Laboratory
Salisbury, Maryland
Phone: (301) 543-6610

Delaware: University of Delaware
Poultry Diagnostic Laboratory
Georgetown, Delaware
Phone: (302) 856-5254

State Department of Agriculture
Dover, Delaware
Phone: (302) 736-4811

Virginia: Virginia State Regulatory Laboratory
Ivor, Virginia
Phone: (804) 859-6221

8. Launder lab coats.
9. Avoid contact with poultry or poultry industry personnel until there is complete decontamination of individual and car.
10. Run car through car wash and spray inside with disinfectant prior to visiting another farm.
11. If for any reason other assistance is needed, radio or telephone your company office.
12. Implement company quarantine.

V. ACTION OF LABORATORY MAKING PRESUMPTIVE DIAGNOSIS OF AN EPD

A. Laboratory making presumptive diagnosis will contact company involved regarding results. This should be done within three hours of submitting chickens to laboratory, if possible.
B. Action after positive laboratory presumptive diagnosis of an EPD:

1. Call DPI office day: (302) 856-2971 or (302) 856-6050; night: (302) 875-5566 Ed Ralph , (302) 337-7278 Bill Stephens or Task Force Chairman.

2. DPI office will schedule meeting (in cooperation with chairman) and call Task Force Members.
3. Contact Federal and State Officials.
4. If need is indicated, immediately send appropriate sample to NADL in AMES, IOWA.

VI. REQUIREMENTS OF COMPANY QUARANTINE

A. Eliminate all service and other visits to that farm, including supervisor, repair and maintenance personnel.
B. Fully inform grower of the problem and danger involved.
C. Specifically restrict movement of grower and family individuals and employees.
D. Suspend feed deliveries until a specific program is outlined by DPI Task Force.
E. Birds will be moved according to procedures outlined by DPI Task Force including dead bird disposal.
F. DPI Task Force will outline procedures for house(s) after removal of birds.
G. Withhold placements until suspect is diagnosed.
H. Post quarantine signs at entrance to farm and on poultry house doors.
I. Procedure for feed deliveries - assisted by flock supervisor:

1. Make delivery a last stop for unloading mixed load.
2. Driver must not enter poultry house.
3. Driver must wear plastic boots.
4. Truck must be run through wash before delivering feed to another farm.
5. Spray disinfectant inside the truck cab.
6. Keep truck doors closed during unloading operation to keep flies and other insects out. Spray household aerosol killer in cab before leaving farm.

J. Grower and family restrictions:

1. Limit flock management to specific individuals.
2. Fully inform these individuals on procedures for clothing, disinfection, dead bird disposal and limitations on their off-farm visiting. No other farms can be visited and should not come in contact with other growers.
3. Other family members working away from the farm must not enter poultry house.
4. Family members who work off the farm must not have contact with any other poultry or pet birds.

VII. ACTIVITIES OF DPI TASK FORCE

A. Immediate meeting to be called after laboratory presumptive diagnosis.
B. Activity:

1. Do epidemiological survey of all activities on farm, especially 72 hours prior to positive presumptive diagnosis.
2. Plan emergency service necessary and establish time schedule for expediting these services.
3. Identify other potentially exposed farms and outline procedure for handling. Use county maps to facilitate this step.
4. Outline and implement appropriate dead bird disposal for all quarantined farms.
5. Make specific recommendations on the company quarantine.

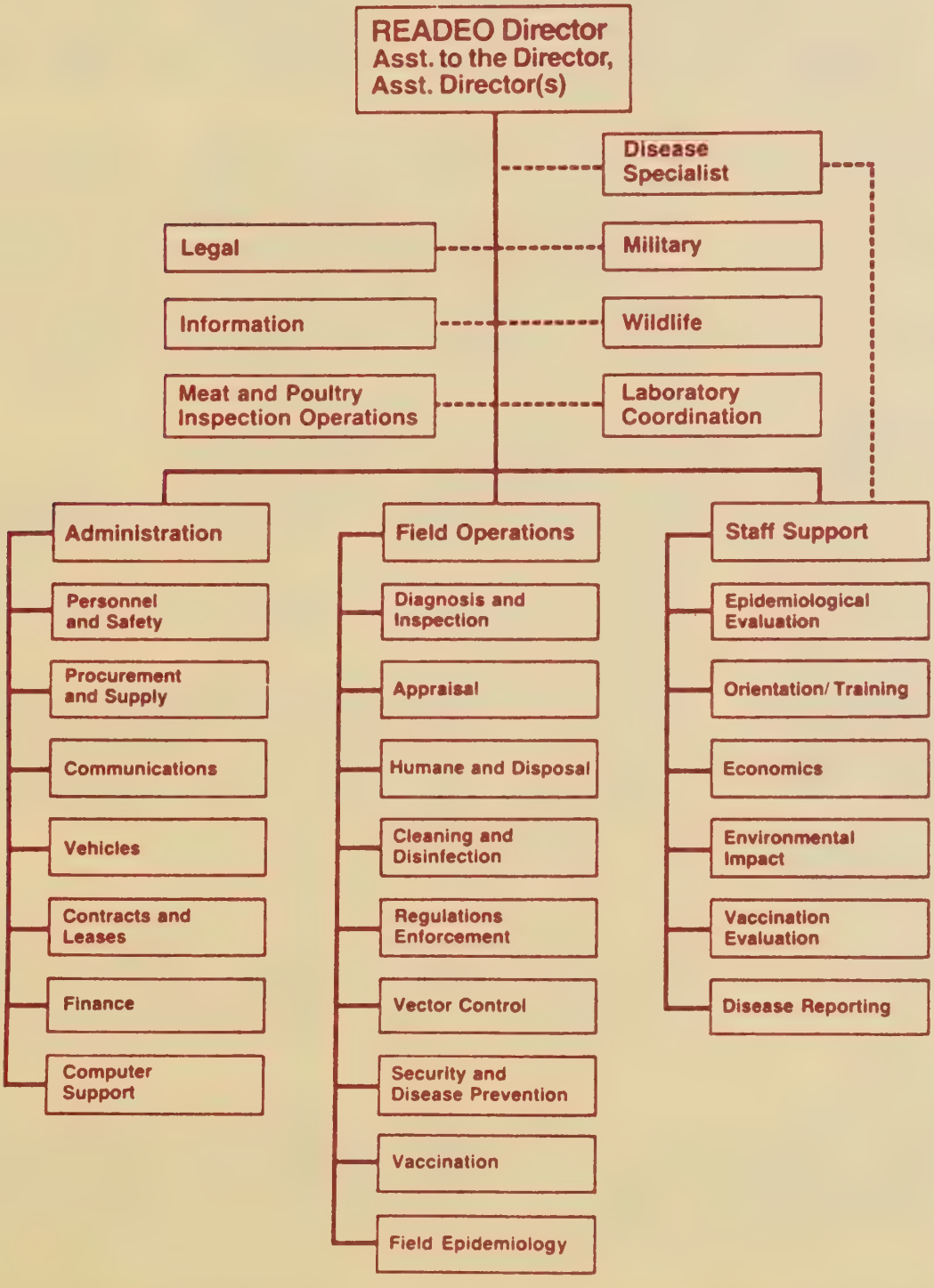
VIII. MISCELLANEOUS COMMENTS

A. All supervisors must have the following emergency kit during an EPD alert:

1. Boots
2. Plastic bags
3. Disinfectant
4. Copy of this procedure manual
5. Brush
6. Bucket
7. Coat or coveralls
8. Cap
9. Rubber Gloves
10. Five quarantine signs (driveway and poultry house door)

B. All newly hired flock supervisors (full or part time) must be given information on how to conduct themselves if they encounter an EPD.

Regional Emergency Animal Disease Eradication Organization (READEO)



APPENDIX 3

CHRONOLOGY OF EVENTS

April 22, 1983	-	Mild form of AI diagnosed in two Lancaster County, Pa., layer flocks.
October 8, 1983	-	Increased mortality (30 percent); drop in egg production noted. Broilers and layer flocks involved.
October 26, 1983	-	Laboratory criteria standardized to meet April 22-24, 1981, criteria established by International Symposium on Avian Influenza. 1/
October 27, 1983	-	Mortality criteria for highly pathogenic AI (HP AI) met at the National Veterinary Services Laboratories (NVSL), Ames, Iowa. Reisolation pending.
October 31, 1983	-	Criteria for HP AI met at NVSL, with reisolation complete.
October 31, thru November 1, 1983	-	Meeting of AI experts as technical collaborators. Recommended declaration of emergency research. State regulatory officials make AI a reportable disease and immediately establish a Federal quarantine around the affected area. State-Federal officials take every step to safely dispose of all dead and diseased birds. Also, recommend continued use of this committee as a collaborating body.
November 3, 1983	-	Meeting with Pennsylvania State officials.
November 4, 1983	-	Meeting of industry officials.
November 4, 1983	-	Federal quarantine in Pennsylvania.
November 4, 1983	-	Task Force Northern Regional Emergency Animal Disease Organization (READEO) activated to enforce Federal quarantine.
November 9, 1983	-	Extraordinary emergency declared in Pennsylvania.
November 9, 1983	-	Office of Management and Budget (OMB) approved $12.5 million.
November 12, 1983	-	First HP AI infected flock depopulated.
November 16, 1983	-	Pennsylvania Federal quarantine expanded.
November 21, 1983	-	Pennsylvania Federal quarantine expanded further.
November 23, 1983	-	Extraordinary emergency declared in New Jersey.
November 23, 1983	-	Federal quarantine imposed in New Jersey due to layer flock declared positive.
November 24, 1983	-	HP AI flock in New Jersey depopulated.
December 6, 1983	-	Technical collaborators meet.
December 8, 1983	-	OMB approves additional funding of $15.2 million, to total $27.7 million.
December 8, 1983	-	Regulations imposed prohibiting interstate movement of live poultry, hatching eggs, and embryonated eggs out of federally quarantined area.

1/ Eight chickens are innoculated with the virus in the laboratory; when six or more die in 8 days, it is called highly pathogenic AI; when one to five of the innoculated chickens die, it is call pathogenic; and when none die within 8 days, it is called nonpathogenic.

December 8, 1983	-	Pennsylvania Federal quarantine expanded further.
December 30, 1983	-	New Jersey Federal quarantine reduced from 400 square miles to approximately 12 square miles. No evidence of spread from initial positive flock.
January 25, 1984	-	OMB approves additional funding of $34 million, to total $61.7 million.
January 25, 1984	-	Extraordinary emergency in Pennsylvania and New Jersey amended to include all forms of H5 AI (Type A) associated with the outbreak (lethal AI).
January 25, 1984	-	9 CFR, Part 53 regulation amended to include AI at 100 percent Federal indemnity level. This was necessary for program activities to be initiated without additional declarations of extraordinary emergency in States other than Pennsylvania and New Jersey.
January 27, 1984	-	9 CFR, Part 81 regulations amended to Federal quarantine portions of Maryland and Virginia, as well as to include lethal AI.
February 29, 1984	-	A portion of the Pennsylvania Federal quarantine area (Franklin County) determined to be free of lethal AI and released.
March 2, 1984	-	Regulations imposed providing for interstate movement of table eggs only from unaffected flocks, as determined by an organized weekly flock surveillance program, including sampling for virus and or/antibodies.
March 6, 1984	-	The remaining portion of the New Jersey Federal quarantine area determined to be free of lethal AI and released. In addition, the extraordinary emergency provisions in New Jersey were removed.
April 2, 1984	-	Increased indemnity rates and made retroactive.
April 5, 1984	-	Federal quarantine area in Cecil County, Md., released.
April 9, 1984	-	Initiated depopulation of serologically positive, previously "low path" flocks.
June 8, 1984	-	Portion of Pennsylvania Federal quarantine area west of Susquehanna River released.
September 14, 1984	-	State and Federal quarantine lifted in Virginia.
October 4, 1984	-	State and Federal quarantine lifed in Pennsylvania. Six-month surveillance program implemented for the previously quarantined areas.

APPENDIX 4

Illustration of Indirect Avian Influenza Impacts in Community, Broilers

Assumptions for Pennsylvania Area:

1. Normal annual production in affected houses is:

   5.5 flocks x 3,402,800 broilers capacity = 18,715,400 broilers

2. Average number of days per flock including cleanout:

   Normal = 365 / 5.5 = 66.4
   AI flocks = 34.2 + 70 = 104.2
   (Average age at AI condemnation is 34.2 days)

3. Accounting for mortality, annual number of chicks placed is:

   Normal = 1.04 x 5.5 x 3,402,800 = 19,464,000.

   AI = 104 days + normal = (365 - 104) = 261 days
   = 1 flock + (261/66.4) =
   = 1 flock + 3.9 flocks = 4.9 flocks

   AI chicks placed = 1.04 x 4.9 x 3,402,800 = 17,340,700.

Feed use loss

Normal = 4.6 tons per 1,000 broilers produced.
AI flock = 2 tons per 1,000 broilers condemned (avg).

Normal feed use:

5.5 x 3.4028 x 4.6 = 86,100 tons

AI feed use:

(1 x 3.4028 x 2) + (3.9 x 3.4028 x 4.6) = 67,900 tons at feed blend price of $223.95/ton, loss is:
223.95 x (86.1 - 67.9) = $4,075,900 loss use
or 18,200 tons loss use

Chicks placed loss

19,464,000 - 17,340,700 = 2,123,300 chicks loss use
at $16.70 per 100 chicks = 0.167 x 2,123,300 = $354,600 loss use.

Fuel use loss

LP use per 1,000 broilers started Nov.-Feb. is:
2.31 x 34 = 78.5 gallons

Loss fuel use is:

78.5 x 2,123,300 = 166,679 gallons loss use
at $0.76 per gallon
0.76 x 166,679 = $126,676 loss use

Processing stage loss

Normal number of broilers processed:
5.5 x 3,402,800 = 18,711,000

Avian influenza number of broilers processed:
3.9 x 3,402,800 = 13,270,900

Loss number broilers processed:

18,711,000 - 13,270,900 = 5,440,100 loss use

Loss for processing labor (Assumes 45 birds processed per worker hour at $4.00 per hour wage including assembly and distribution.)

5,440.1/45 = 120,900 worker hour loss.

Cut-up: assume 40 percent cut-up, 125 birds cut-up per worker hour
(5,440,100 x 40)/125 = 17,400 worker hours loss.

Processing labor loss is:

120.9 + 17,400 = 138,300 hours loss use
or 4 x 138,300 = $553,200 loss use

Processing capacity in Pa. is approximately 10 million broilers per month or 115 million per year (based on 1982 production data)

Normal fixed cost for processing is approximately 5 cents per bird (survey) or about $5.8 million per year. Increase in fixed cost per broiler processed for the year is:

($5.8 million/(115 million - 5.4 million) - .05
= .053 - .050 = $.003 per bird processed for year increase in fixed processing cost.

Appendix table 1.--Indemnity values for commercial layers

Age	Value per bird	Age	Value per bird
Weeks	Dollars	Weeks	Dollars
1	0.58	36	3.66
2	.67	37	3.58
3	.77	38	3.48
4	.93	39	3.40
5	1.05	40	3.31
6	1.16	41	3.22
7	1.31	42	3.14
8	1.48	43	3.05
9	1.60	44	2.97
10	1.75	45	2.87
11	1.87	46	2.79
12	2.01	47	2.70
13	2.15	48	2.62
14	2.33	49	2.53
15	2.50	50	2.45
16	2.64	51	2.35
17	2.83	52	2.27
18	3.16	53	2.18
19	3.50	54	2.09
20	3.84	55	2.01
21	4.18	56	1.92
22	4.34	57	1.84
23	4.42	58	1.74
24	4.44	59	1.66
25	4.44	60	1.57
26	4.44	61	1.49
27	4.44	62	1.40
28	4.35	63	1.29
29	4.27	64	1.22
30	4.18	65	1.13
31	4.10	66	1.05
32	4.00	67	.96
33	3.92	68	.92
34	3.83	69	.92
35	3.75	70	.92
		71	.92
		72	.92

Appendix table 2.--Indemnity values for molted commercial layers

Age	Value per bird	Age	Value per bird
Weeks	Dollars	Weeks	Dollars
64	1.16	86	1.56
65	1.36	87	1.52
66	1.60	88	1.48
67	1.84	89	1.44
68	2.02	90	1.40
69	2.15	91	1.36
70	2.19	92	1.32
71	2.15	93	1.28
72	2.11	94	1.24
73	2.07	95	1.21
74	2.03	96	1.16
75	2.00	97	1.12
76	1.96	98	1.08
77	1.92	99	1.04
78	1.88	100	1.00
79	1.84	101	.96
80	1.80	102	.92
81	1.76	103	.92
82	1.72	104	.92
83	1.68	105	.92
84	1.64	106	.92
85	1.60		

Appendix table 3.--Indemnity values for brown egg layers

Age	Value per bird	Age	Value per bird
Weeks	Dollars	Weeks	Dollars
1	0.58	31	4.71
2	.69	32	4.60
3	.82	33	4.51
4	.96	34	4.40
5	1.08	35	4.31
6	1.22	36	4.20
7	1.40	37	4.11
8	1.60	38	4.00
9	1.76	39	3.91
10	1.91	40	3.80
11	2.09	41	3.70
12	2.25	42	3.60
13	2.42	43	3.50
14	2.63	44	3.40
15	2.82	45	3.30
16	2.99	46	3.21
17	3.22	47	3.10
18	3.58	48	3.02
19	3.99	49	2.91
20	4.38	50	2.82
21	4.76	51	2.71
22	4.95	52	2.62
23	5.03	53	2.51
24	5.11	54	2.41
25	5.11	55	2.31
26	5.11	56	2.21
27	5.11	57	2.11
28	5.00	58	2.01
29	4.91	59-72	2.00
30	4.80		

Appendix table 4.--Indemnity values for molted brown egg layers

Age	Value per bird
Weeks	Dollars
64	2.13
65	2.26
66	2.39
67	2.53
68	2.66
69	2.79
70	2.93
71	2.89
72	2.85
73	2.81
74	2.77
75	2.73
76	2.69
77	2.65
78	2.61
79	2.57
80	2.53
81	2.49
82	2.45
83	2.41
84	2.37
85	2.33
86	2.29
87	2.25
88	2.21
89	2.17
90	2.13
91	2.09
92	2.05
93 1/	2.00

1/ Beyond 93 weeks, $2.00.

Appendix table 5.--Indemnity values for breeder turkeys

Not selected as breeders			Selected as breeders 1/		Enter breeder house 1/	
Age	Female	Toms	Age	Hen value	Age	Hen value
Weeks	- - Dollars - -		Weeks	Dollars	Weeks	Dollars
1	3.70	4.66	16	12.20	30	21.25
2	3.96	5.01	17	12.74	31	22.05
3	4.19	5.29	18	13.39	32	22.65
4	4.42	5.58	19	13.97	33	23.25
5	4.69	5.87	20	14.57	34	23.25
6	4.97	6.18	21	15.20	35	23.25
7	5.28	6.52	22	15.80	36	23.00
8	5.61	6.87	23	16.40	37	22.00
9	5.97	7.29	24	17.00	38	21.00
10	6.34	7.74	25	17.60	39	19.50
11	6.73	8.21	26	18.20	40	18.00
12	7.14	8.75	27	18.80	41	16.50
13	7.54	9.37	28	19.40	42	15.00
14	7.96	10.13	29	20.00	43	13.50
15	8.42	10.89			44	12.00
16	8.91	11.65			45	10.50
17	9.34	12.50			46 & on	9.00

1/ After selection, indemnity is based on the number of hens and includes the value of the toms.

Appendix table 6.--Indemnity value of broiler breeder females (includes value of males, but counts only females)

Age	Value per hen	Age	Value per hen
Weeks	Dollars	Weeks	Dollars
1	1.40	31	5.36
2	1.52	32	5.27
3	1.64	33	5.18
4	1.84	34	5.09
5	1.98	35	5.00
6	2.13	36	4.91
7	2.29	37	4.82
8	2.47	38	4.73
9	2.77	39	4.64
10	3.04	40	4.55
11	3.21	41	4.46
12	3.38	42	4.37
13	3.55	43	4.23
14	3.73	44	4.19
15	3.90	45	4.10
16	4.07	46	4.01
17	4.24	47	3.92
18	4.42	48	3.83
19	4.59	49	3.74
20	4.76	50	3.65
21	4.93	51	3.56
22	5.10	52	3.47
23	5.27	53	3.38
24	5.45	54	3.29
25	5.63	55	3.20
26	5.63	56	3.11
27	5.63	57	3.02
28	5.63	58	2.93
29	5.54	59	2.84
30	5.45	60	2.75
		61 1/	2.66

1/ Beyond 61 weeks 2.66.

Appendix table 7.--Indemnity values for layer breeders
(includes value of males, but counts only females)

Age	Value per hen	Age	Value per hen
Weeks	Dollars	Weeks	Dollars
1	5.810	35	7.780
2	5.862	36	7.578
3	5.984	37	7.376
4	6.193	38	7.174
5	6.262	39	6.972
6	6.384	40	6.770
7	6.541	41	6.568
8	6.689	42	6.366
9	6.820	43	6.164
10	6.977	44	5.962
11	7.107	45	5.760
12	7.273	46	5.558
13	7.438	47	5.356
14	7.604	48	5.154
15	7.795	49	4.952
16	7.970	50	4.750
17	8.161	51	4.548
18	8.327	52	4.346
19	8.510	53	4.144
20	8.710	54	3.942
21	8.931	55	3.740
22	9.132	56	3.538
23	9.253	57	3.336
24	9.334	58	3.134
25	9.375	59	2.932
26	9.396	60	2.730
27	9.396	61	2.528
28	8.992	62	2.326
29	8.790	63	2.124
30	8.790	64	1.922
31	8.588	65	1.720
32	8.386	66	1.518
33	8.184	67	1.316
34	7.780	68	1.20
35	7.780	69	1.20
		70	1.20